MARYLAND DEPARTMENT OF THE ENVIRONMENT
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March 29, 2012

Lorie Baker
Jan Szaro
Site Assessment and Non-NPL Federal Facilities Branch (3HS12)
US EPA Region III
1650 Arch Street
Philadelphia, PA 19103-2029

RE: DRUMCO Site Inspection

Dear Ms. Baker and Mr. Szaro:

Enclosed is Revision II of the DRUMCO Site Inspection (SI) Report prepared by the Maryland Department of the Environment, CHS Enforcement Division (MDE). The site is located in Baltimore City, Maryland.

The SI for the DRUMCO site was submitted earlier this year. Subsequent to that submittal MDE received an analytical packet that had not previously been incorporated into the report. Revision II incorporates all the data and corrects some minor details in the previous version of the report. Please replace the body of the report and the toxicological evaluation with the enclosed revised pages.

If you have additional questions concerning this matter, please contact me at (410) 537-3449.

Sincerely,

Alex M. Cox, Project Manager
CHS Enforcement Division

Enclosure

cc: Mr. Horacio Tablada
Mr. James Carroll

SITE INSPECTION
of the
DRUMCO SITE (MD-408)

Revision II

March 26, 2012

Prepared by: Maryland Department of the Environment
Land Management Administration
1800 Washington Boulevard
Baltimore, MD 21230

Prepared for: U.S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103-2029

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VOLUME II

1.0 INTRODUCTION

1.1 Authorization

This Site Inspection (SI) was performed by the Maryland Department of the Environment (MDE), Land Management Administration, Land Restoration Program (LRP) under a Cooperative Agreement with the U.S. Environmental Protection Agency (EPA).

1.2 Scope of Work

LRP's CHS Enforcement Division performed a SI of the former Drumco facility (MD-408), EPA identification number MDD985386119. The purpose of this SI is to characterize potential impacts from past industrial activity on groundwater, surface water, sediments and soil on site. The scope of the investigation included the collection of surface water, sediment, soil and groundwater samples to determine if hazardous wastes have impacted the property.

1.3 Executive Summary and Conclusions

The Drumco Site (the "Site") has been an industrial property zone since the 1880s. The South Baltimore Harbor Improvement Company obtained the land from the Pennington family in 1882. They transferred the property to the Curtis Bay Highlands Company in 1918. Between 1923 and 1966 the Charles S. Walton & Company, Inc. operated a tannery on the property. The tannery was abandoned at an undefined time just prior to 1966 and the structures razed. From the mid 1970s to approximately 1980, the Site was used as a construction debris landfill with significant mounding of unknown fill materials over the previous ground surface and extension of fill into wetland areas on the southern and southeastern portions of the Site. Around 1990, hazardous waste from a drum reconditioning operation was illegally stored on the property now known as 1500 Arundel Blvd. EPA conducted an emergency drum removal action in 1991 due to a concern about hazardous substances leaking from drums and posing a threat to human health and the environment.

Several investigations followed this emergency removal. All previous investigations were concerned primarily with the surface of the Drumco facility. In 2007 MDE was requested to perform an SI on the former Drumco site. MDE requested site access from the current owners in 2007. After protracted negotiations, access was granted in the spring of 2010. Based on information obtained after the 1991 removal action, MDE determined that an intensive subsurface investigation was necessary in order to characterize previous use of the property. EPA concurred with this assessment and approved a SAP in April of 2010.

For this SI, 38 soil samples, fourteen groundwater samples, three surface water samples and three sediment samples (including duplicates) were collected and submitted for chemical analysis for Target Analyte List (TAL) inorganics and Target Compound List (TCL) organics. Significant levels of environmental contamination were detected at the Drumco Site. PCBs, hexavalent chromium, petroleum byproducts, poly-aromatic hydrocarbons and heavy metals were

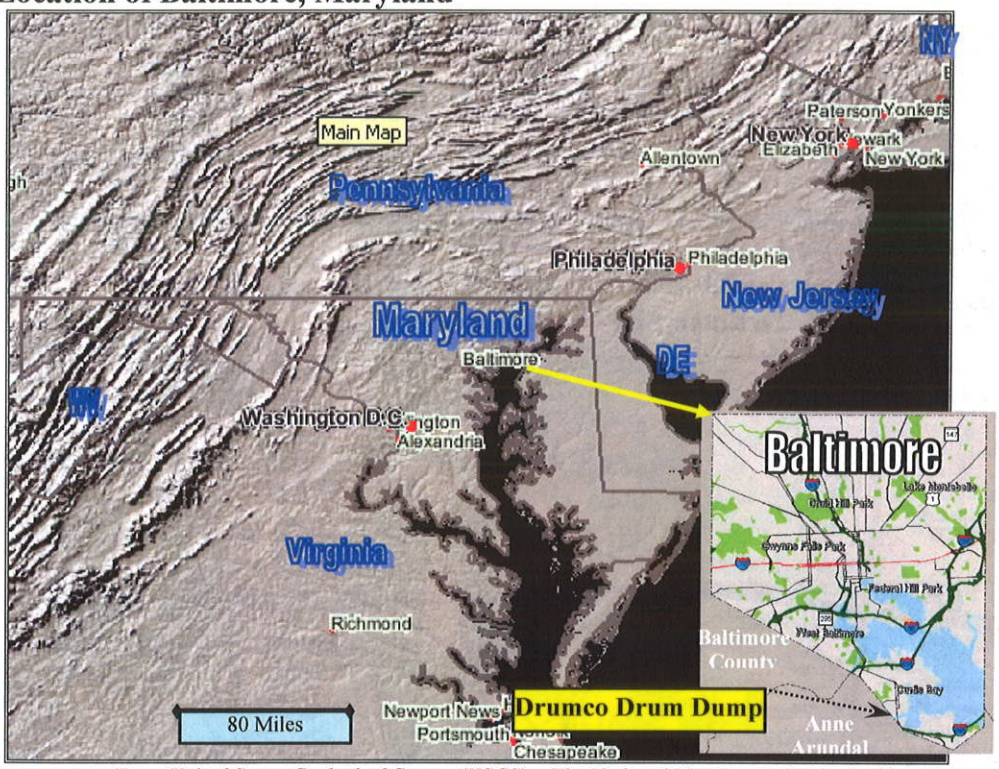
identified in significant levels. Many of these contaminants were documented in levels greater than the allowable levels documented in the MDE March 2008 Site Cleanup Standards and/or November 2010 EPA Risk-Based Concentrations (RBCs).

A toxicological evaluation was conducted by LRP from the data collected during this SI. Results of the toxicological evaluation, utilizing a commercial scenario, identified elevated noncarcinogenic Hazard Indices (greater than 1) and elevated Cancer Risks (greater than one person in a million contracting cancer) for all population evaluated due to exposures to the soil and groundwater on site. The toxicological evaluation found significant risks from the ingestion, inhalation or dermal contact with site contaminants.

2.0 SITE DESCRIPTION

The former Drumco Drum Dump Property is located approximately ¼ mile south of Curtis Bay, off Pennington Avenue (Route 173). The Site is situated between the southwestern Baltimore City Limit and Anne Arundel County, Maryland (Figure 1). The 14.243-acre parcel of land is a former landfill situated in an industrial setting. The primary portion of the parcel under investigation (14.193 acres) lies in Anne Arundel County and 0.05 acres of the parcel lie in Baltimore City. The Site is currently owned by WHD Properties, LLC with a listed street address of 1500 Arundel Boulevard, Baltimore, Maryland 21255. The Site is identified on the Anne Arundel County Tax map 5, grid 3, parcel 47.

Figure 1: Location of Baltimore, Maryland



From United States Geological Survey (USGS) – The National Map Data Distribution System

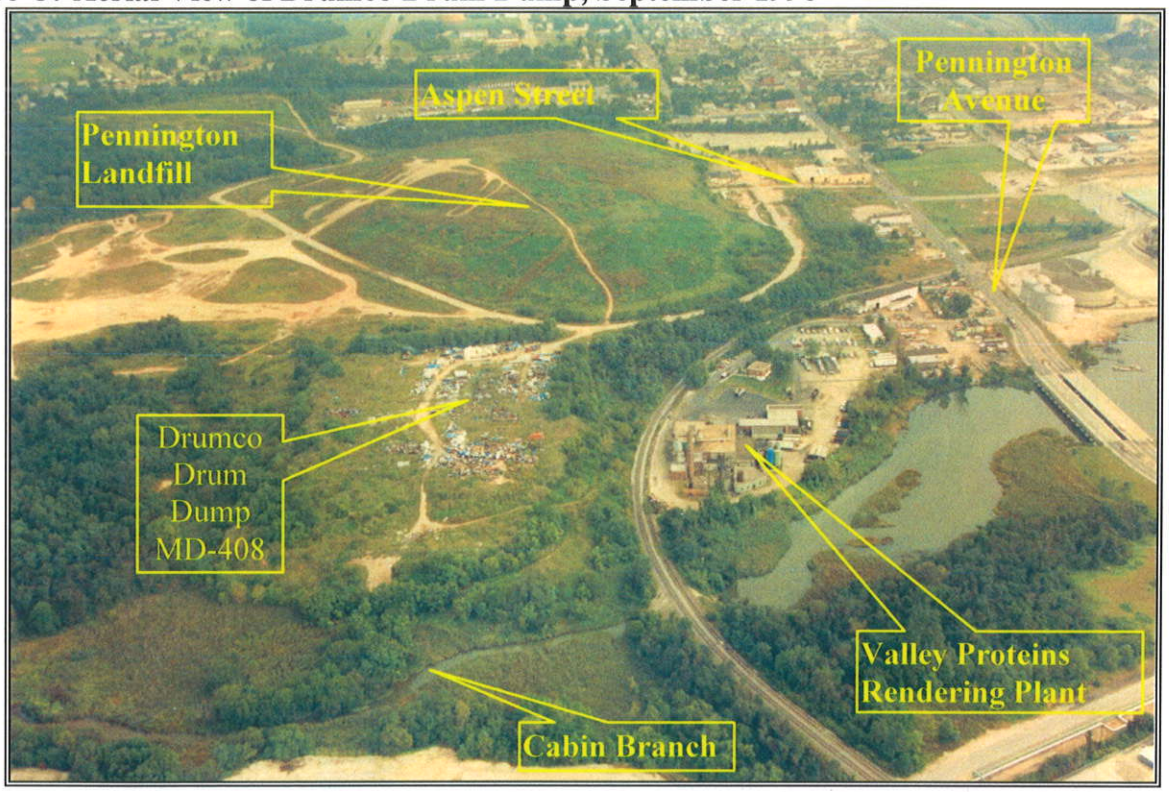
Access to the Site is by way of Aspen Street off Pennington Avenue in Baltimore. The geographic coordinates are North 39° 12' 45" and west 76° 35' 30" longitude. The Maryland grid coordinates for the Site are 502,800 feet north by 915,900 feet east. The former Drumco Drum Dump was a drum storage yard, which was owned by Drumco, Inc for the purpose of recycling drums. The Site previously consisted of numerous drum piles that together covered approximately five acres of the 14-acre tract (Figure 6). All of the drums were removed from the Site in the early 1990s.

Elevation at the Site ranges from approximately two feet above Mean Sea Level (MSL) in the south to fifty feet above MSL in the northern portion of the Site (Figure 7).

Figure 2: Topographic Map – Former Drumco Property

The former Drumco Drum Dump Site consists of a mounded grassy plateau surrounded by trees growing along the slopes of the plateau (Figure 2). The southern portion of the Site is situated on illegally backfilled wetlands. The Valley Proteins rendering plant is located to the east of the Site beyond the railroad tracks. The Baltimore Pennington Landfill (now closed) is located to the north of the Site. The southern portion of the Site lies adjacent to wetlands and the tidally influenced portion of Cabin Branch. A Hess Petroleum Terminal is located south of Cabin Branch and the Drumco Drum Site. Cabin Branch flows into Curtis Bay, which is contiguous with Baltimore Harbor and the Chesapeake Bay. An intermittent stream valley lies directly to the west of the Site.

Figure 3: Aerial View of Drumco Drum Dump, September 1990



The Site is located in an industrial section of northern Anne Arundel County in Congressional District 1 and Legislative District 31. No residents are located on-site; 132 residents are located within 0.25 miles of the Site; 567 residents are located between 0.25 miles and 0.5 miles of the Site; and 5,655 residents are located between 0.5 miles and one mile of the Site (Figures 9A and 9B). The average annual precipitation for the Baltimore region is 41.94 inches. There are six wellhead protection areas for approximately 15 wells serving the Glen Burnie area within four miles of the Site. Four areas protect Patapsco Formation wells and two areas protect Patuxent Formation wells.

Most of the Site (except the southern portion) is located above the 100- and 500-year floodplain. The Site lies within a Resource Conservation Area and Smart Growth Priority Funding Area. Intensely developed areas are located across Cabin Branch to the south and Pennington Avenue. Palustrine wetlands occupy the southern portion of the Site along Cabin Branch. Estuarine wetlands associated with the Cabin Branch tidal marsh are located approximately 100 feet to the southwest. The former Drumco Site is located in a Resource Conservation Area (Figures 5).

Figure 4: Land Use Map

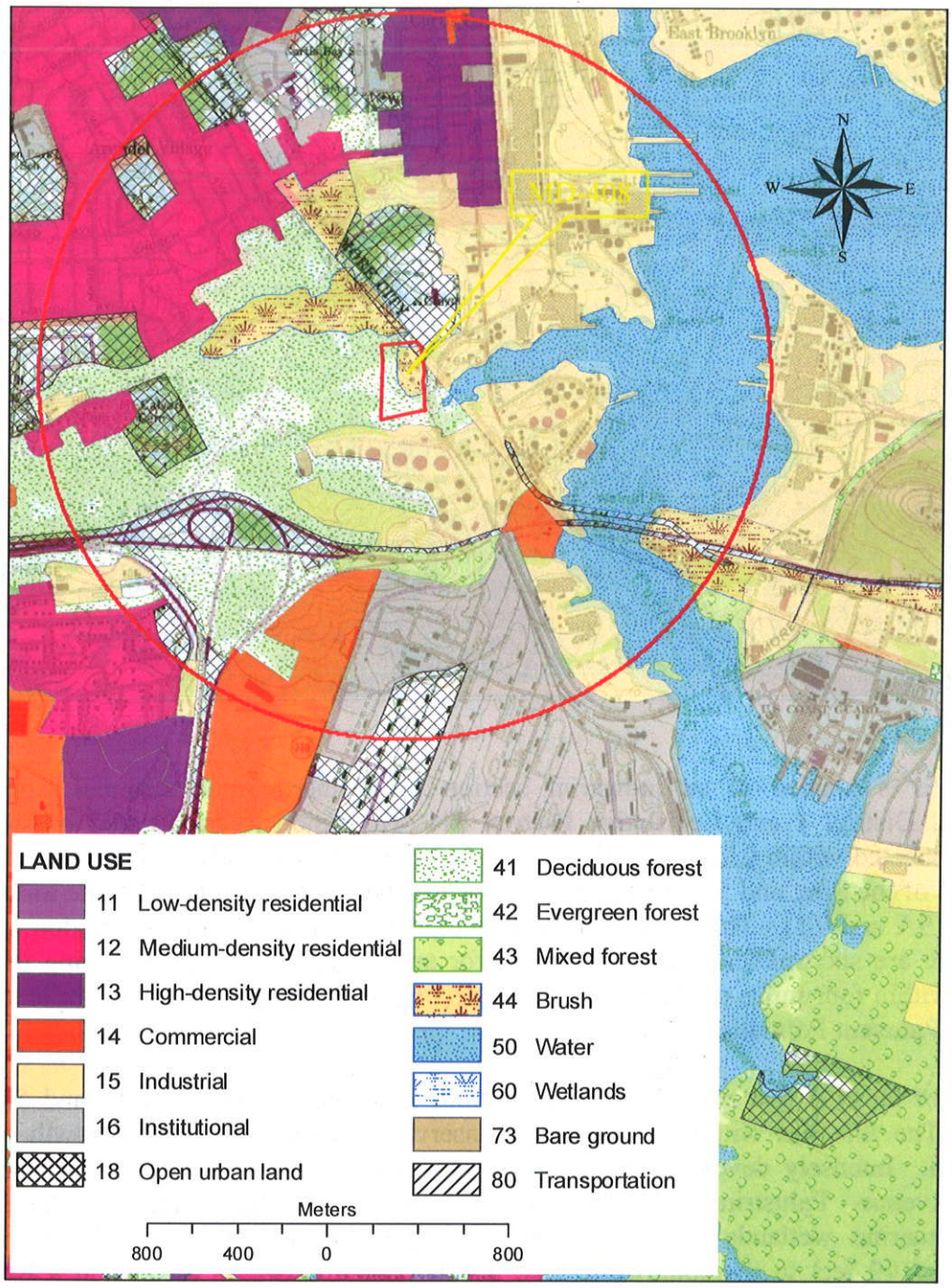
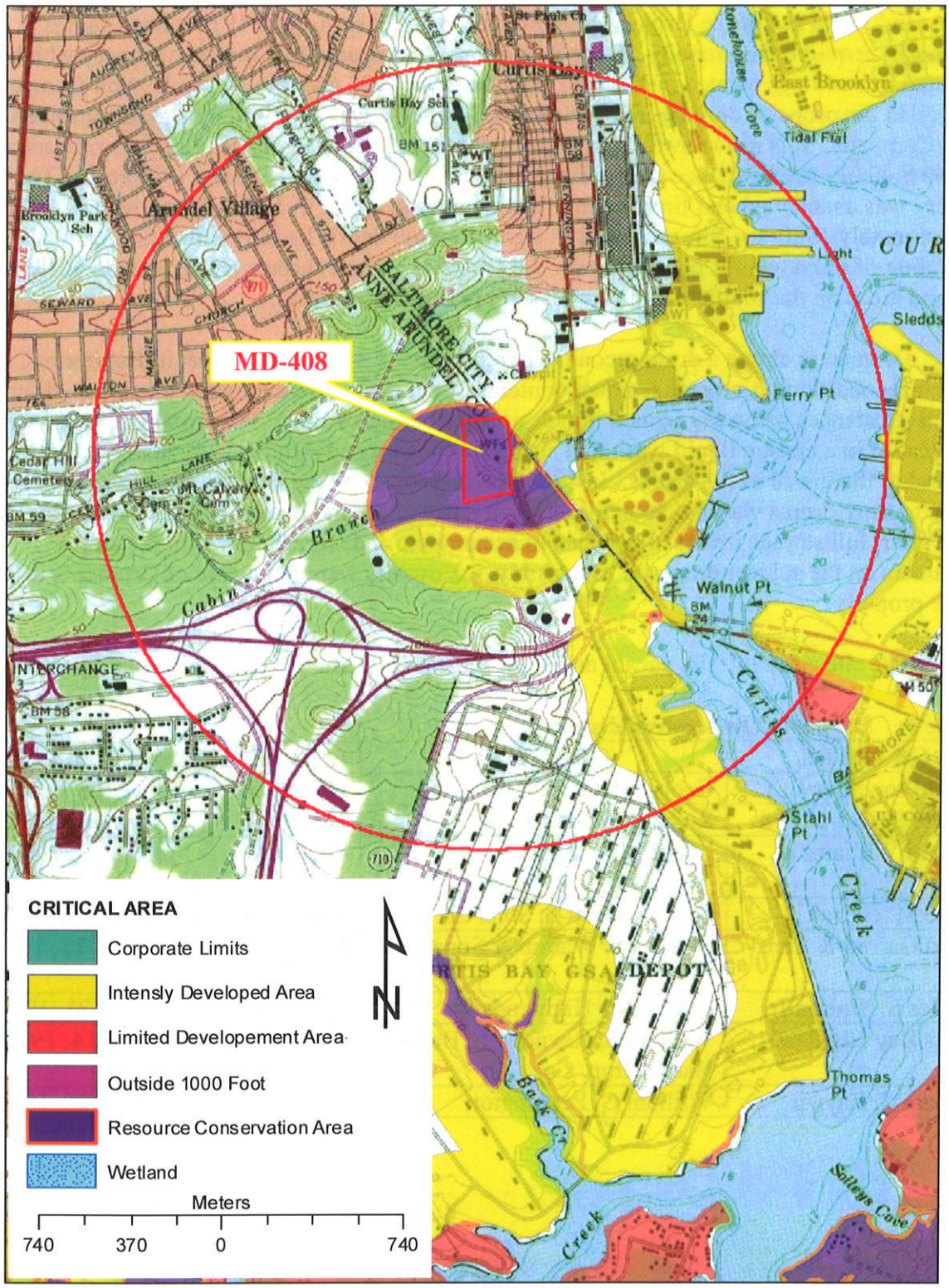


Figure 5: Critical/Sensitive Areas Map



2.1 Site Ownership and Use

Industrial use of the Drumco Site property dates back to June 1919 when Charles S. Walton Jr. acquired the property. Chas S. Walton & Company, Inc. owned a tannery which operated in buildings located on the Site from between 1923 and 1953. The Walton Company controlled the property until approximately 1953, when it was acquired by David Garratt and Sons Company. It is not known if the tannery continued operation under Garratt's ownership but a 1966 Sanborn fire insurance map indicates the tannery property is vacant (Figure 7). The tannery was abandoned and finally demolished sometime prior to 1970. From the mid 1970s to approximately 1980, the Site was used as a construction debris landfill with significant mounding of unknown fill materials over the previous ground surface and extension of fill into wetland areas on the southern and southeastern portions of the Site.

Drumco operated a drum reconditioning facility at 1427 Bank Street in Baltimore City. In their reconditioning process residual contents of old drums were emptied into waste drums, similar substances being segregated into designated storage drums. The emptied drums were then placed in a caustic liquid wash that stripped old paint and removed any material that adhered to the inside of the drums. In 1985, Drumco outgrew the Bank Street storage space and began to store drums waiting reconditioning on a parcel of land owned by the Garratt Family. Soon after, full storage drums also began to accumulate and were stored with the empty containers on the subject property. Ostensibly, the owners were not aware of Drumco's misuse of the property.

The site currently sits vacant and signs indicate it is often used as an illegal open dump.

Table 1: Property Ownership History

GRANTEE	GRANTOR	LIBRE/FOLIO	DATE
WHD Properties LLC	George P. Garratt 3rd	15999/189	March 1, 2005
George P. Garratt 3rd	Richard Williams	15999/183	January 16, 2001
Richard Williams et. al.	Louse M. Garratt	4025/701	Dec. 9, 1985
Louse M. Garratt	David Garratt & Sons Co.	WGL 2679/29	Nov. 10, 1970
David Garratt & Sons Co.	Charles S. Walton & Sons Co.	JHH 786/39	Sept. 11, 1953
Charles S. Walton Jr.	Curtis Bay Highlands Inc.	WNW 5/454	June 21, 1919
Curtis Bay Highlands Inc.	William S, Rayner – S. Balto. Harbor Imp. Co.	GW 147/86	Jan. 14, 1918
William S. Rayner	William C. Pennington	SH 20/29	June 26, 1882

Figure 6: Property Map for Drumco Site

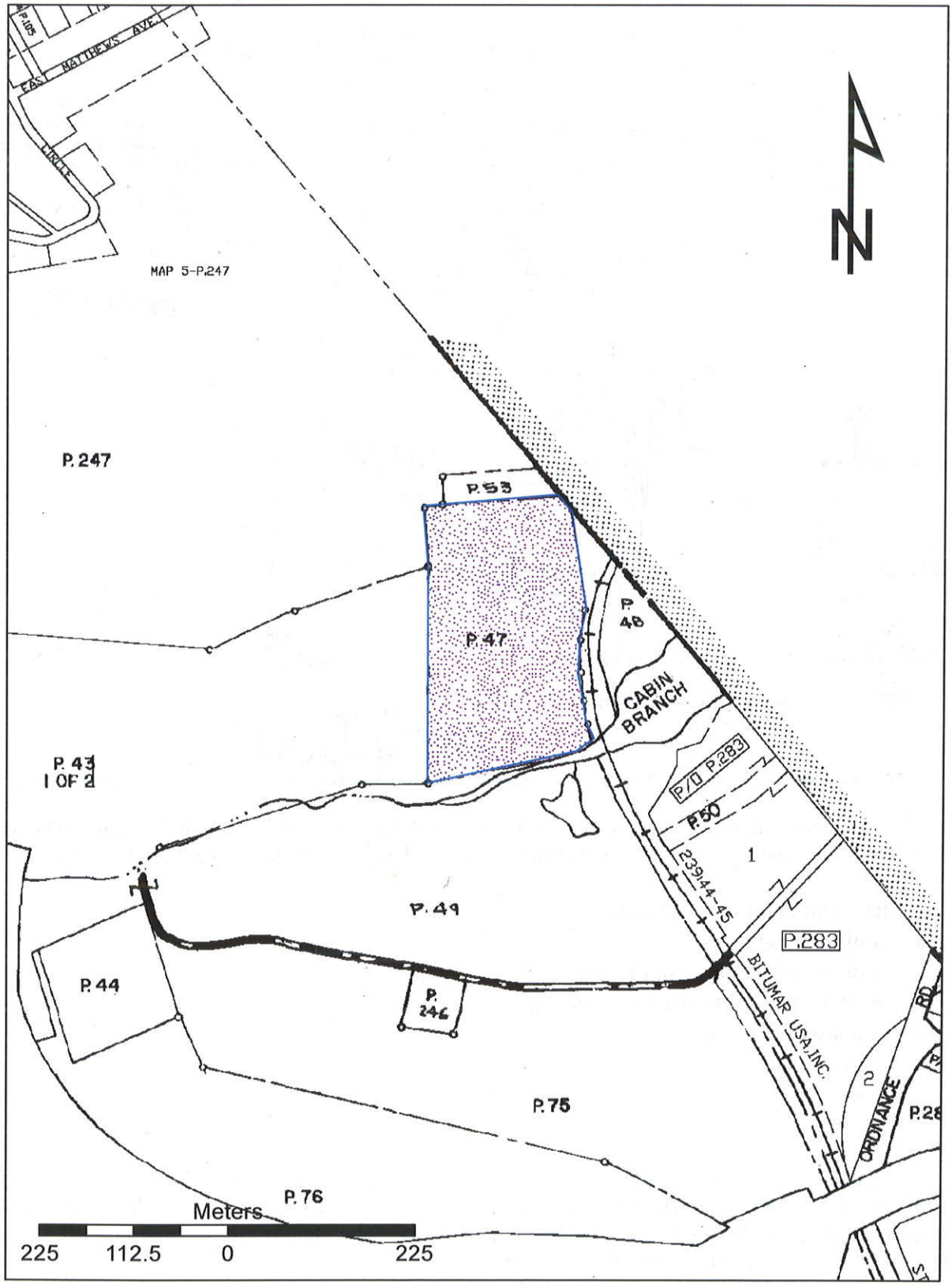
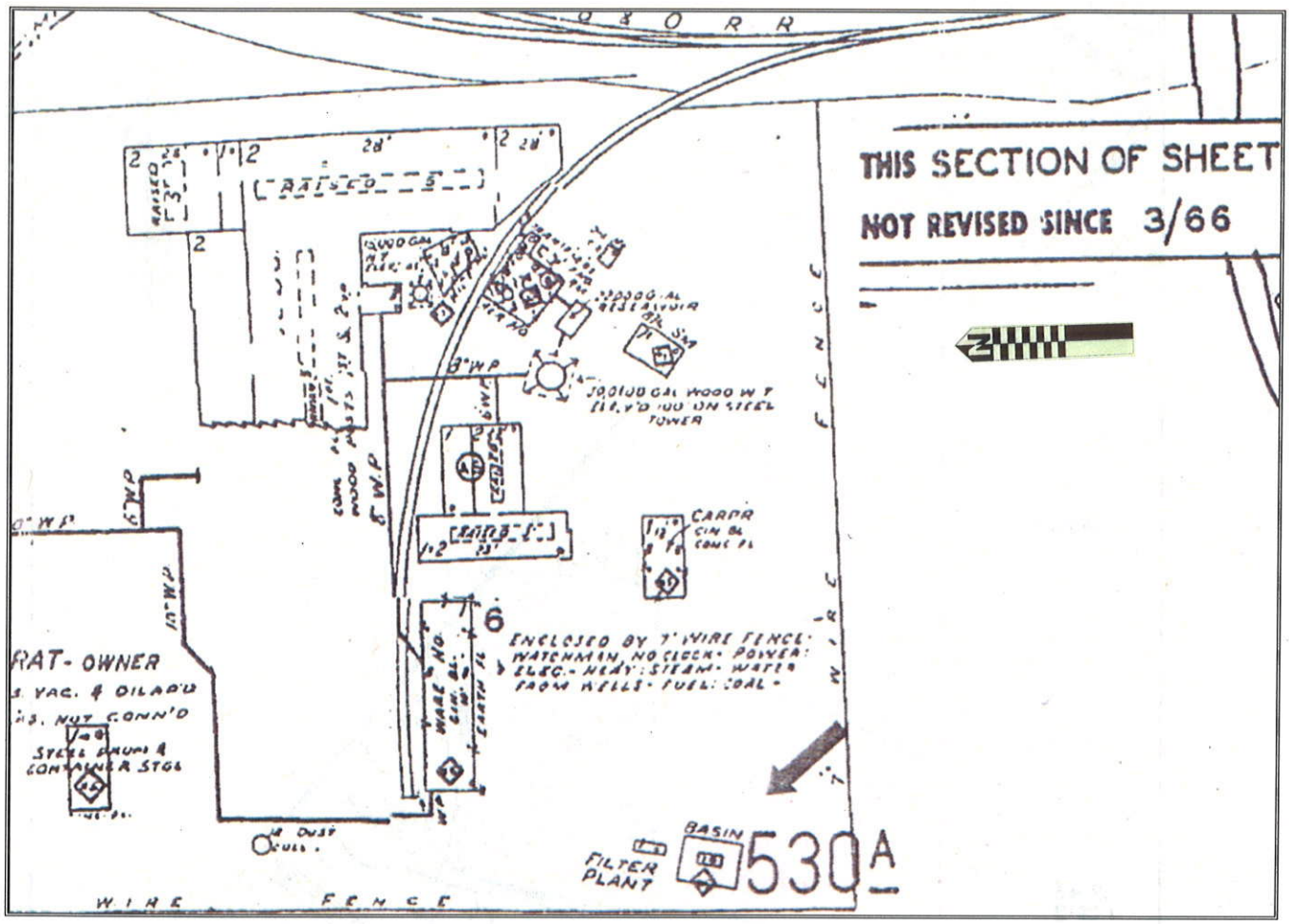


Figure 7: Sanborn Map of the Former Tannery



The tanning industry typically uses chemicals for dehairing, liming, deliming, tanning and curing. The following is a partial list of chemicals that are/were commonly utilized in tanning industries:

- trivalent chromium sulfate,
- sodium bicarbonate,
- sodium sulfide or sodium sulfhydrate,
- arsenic or cyanide as sharpening agent
- ammonium sulfate,
- sulfuric acid,
- lime,
- aniline dyes

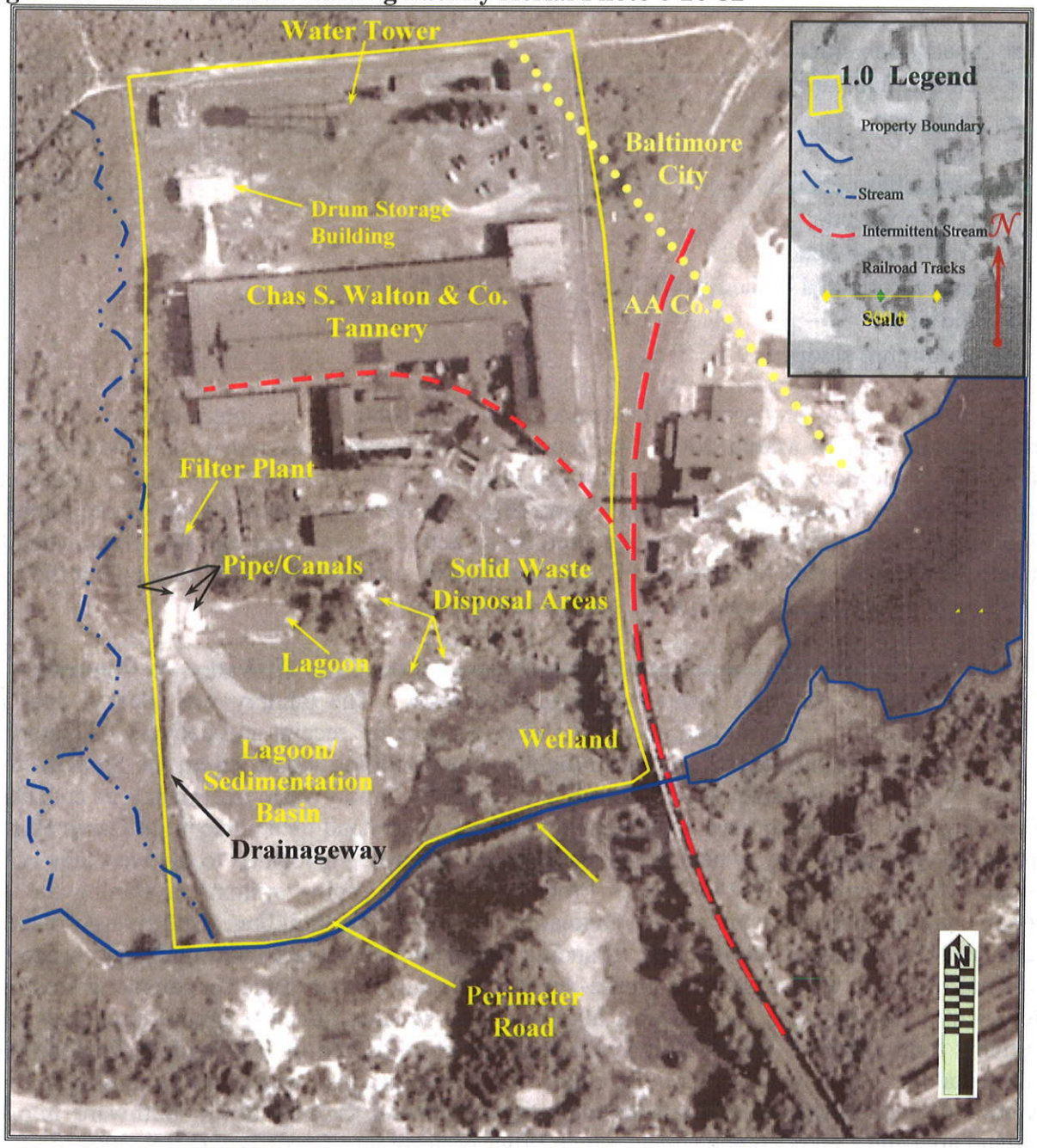
Additional chemicals of concern (COCs) described at other tanning sites on the National Priorities List (NPL) such as the Winchester Tannery Site in Winchester, Cheshire County, New Hampshire; the Mohawk Tannery facility in Nashua, Hillsborough County, New Hampshire; and the Pownal Tanning Site in the Village of North Pownal, Vermont include:

- acid wastes,
- methylene chloride,
- caustic substances,
- cadmium,
- lead,
- pentachlorophenol,
- chlorobenzene,
- trichloroethylene,
- polychlorinated biphenyls (PCBs),
- dioxins
- chromium sludges

The U.S. EPA Environmental Sciences Division published an interpretation of historic aerial photographs in March 2008. The report, Aerial Photographic Analysis of the Bohager Dump Site, Baltimore, Maryland also included analysis of the Drumco Drum Dump, which was located south of the suspected Bohager Dump Site. The document details aerial photographs of the property from 1950 when it was occupied by an active tannery, through the 1960s when the tannery was demolished, through the 1970s when landfill activities occurred throughout the Site, to 1980 when probable Drumco Drum storage activities began.

In the June 20, 1952 aerial photograph (Figure 8), the Chas S. Walton & Company, Inc. tannery appears to be in its prime period of production. The tannery was located near the Baltimore and Ohio Railroad and operated a side rail spur for receipt and delivery of materials. In the northwest portion of the property a lighter toned building identified on the Sanborn Map (Figure 7) as containing steel drums is visible. A probable liquid waste treatment area consisting of two lagoons appears to have been created in a natural wetland area adjacent to Cabin Branch Creek and a drainage way, which flows directly into the creek, is located to the west side of the probable treatment area (EPA, 2008). Probable canals or piping systems sustaining the two lagoons and drainage way are visible emanating from the filter building. Solid waste disposal areas are located east of the lagoons. It should be noted that in the tanning industry, waste pits were used for acid wastes from the grease-rendering fleshing process and for caustic wastes from the patent leather process. In addition, alkaline waste streams from the tanning processes were routinely transported to filter buildings for removal of solids and then to lagoons for long-term sedimentation. Wastewater potentially containing chromium also was typically discharged into rivers and creek systems. Overall, drainage in the general vicinity flows southward into the wetland area and Cabin Branch Creek, which flows easterly into Curtis Bay (EPA, 2008).

Figure 8: Chas S. Walton Tanning Facility Aerial Photo 6-20-52

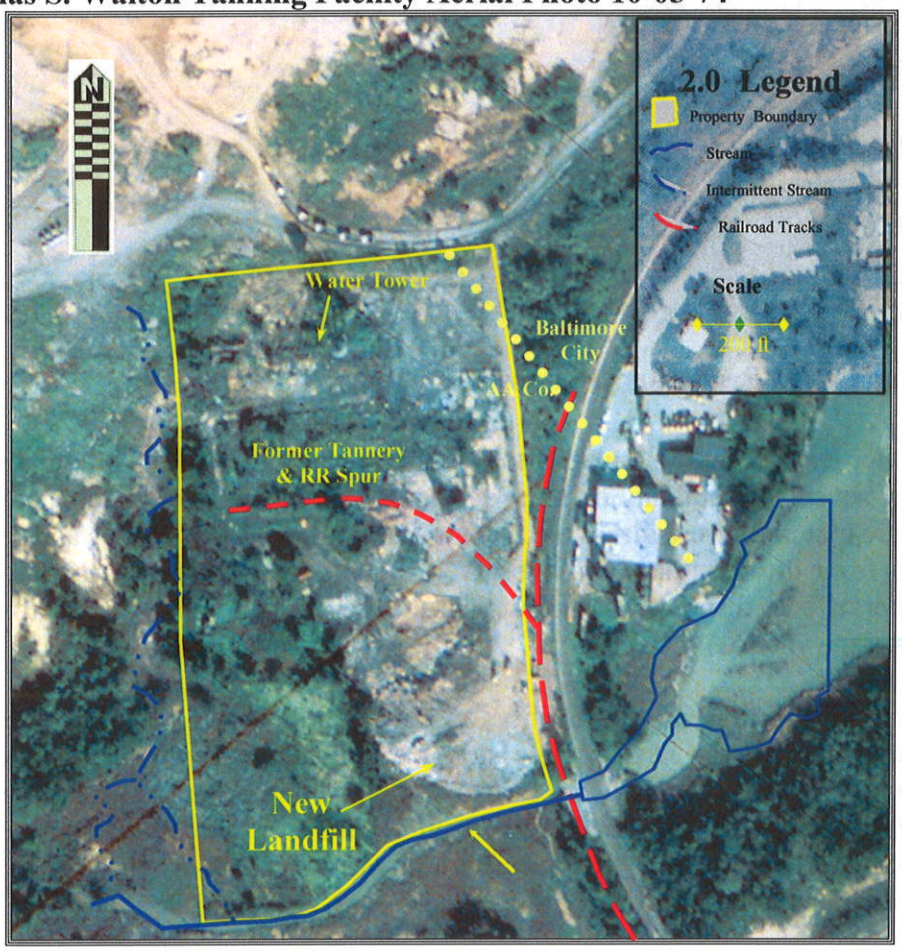


The probable liquid waste treatment areas and the solid waste disposal areas are no longer visible on the September 25, 1957 aerial photograph. However, drum piles and areas of debris are discernable within the tannery property (EPA, 2008). Based on these observations, it appears that operations at the tannery had been significantly reduced by 1957. On October 13, 1963 new areas of possible solid waste and debris are visible (EPA, 2008). Most of the debris piles appear in the northern portion of the Site east of the drum storage building and north of the primary tannery building. By February 21, 1966, a blackened area appears where the primary tannery building was located indicating that the building has been demolished or possibly

destroyed by fire. This portion of the building is also missing from the 1966 Sanborn Map (Figure 7). Piles of drums, possible solid waste, and debris are still present in the northern portion of the Site.

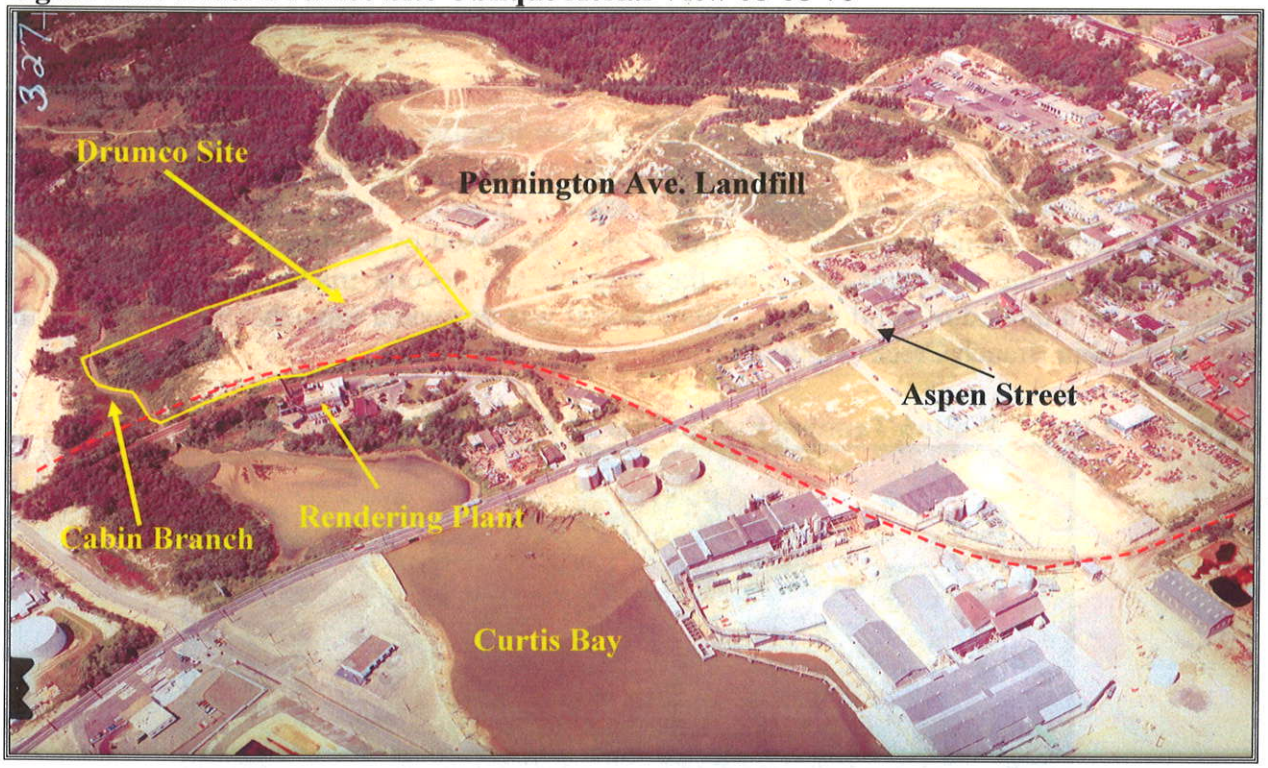
By September 1970, the former tannery appears inactive as all of the primary buildings have been demolished/burned down and vegetation appears within the main tannery building. The former Drumco Site is overgrown in 1973 with no activity. In October 1974, most of the drums and debris are no longer visible. However as described by EPA, a new landfill area has been created in the southeast corner of the property and several trucks are visible on what appears to be a mound of solid waste. This material was deposited immediately adjacent to the mouth of Cabin Branch Creek (Figure 9).

Figure 9: Chas S. Walton Tanning Facility Aerial Photo 10-05-74



In 1976, significant grading and filling activity is present. It has been observed that the Former Drumco Site received rubble and construction debris fill from approximately 1975 until the early 1980s. It is estimated from the change in topography that approximately 30,000 to 40,000 cubic yards of fill were received (CES, 2004). However, CES reported that it was not known whether any of the materials brought onto the Site were hazardous.

Figure 10: Former Drumco Site Oblique Aerial View 08-08-76



2.2 Environmental Regulatory Actions

The former Drumco Drum Dump Site was first inspected by MDE on September 26, 1990 in response to several complaints of hazardous materials being stored on the Site. Leaking drums of caustic materials were discovered in a trailer used for drum storage and evidence of soil contamination from drum spillage was observed. The drums were subsequently removed by MDE for proper off-site disposal; the operator of the facility, Mr. George Garratt was advised to clean up the storage yard.

During an inspection of the facility on January 12, 1991, MDE observed that Site conditions had deteriorated. Drums were stored chaotically throughout the Site and spillage from drums was evident. MDE issued a formal complaint and order to Drumco Inc., on January 21, 1991, for violations of Maryland water control and solid waste management laws. Mr. George Garratt was subsequently found guilty and was sentenced to 90 days in jail and fined $50,000 for violations of Maryland Environmental Laws.

In March 1991, MDE investigated the Drumco Site in response to a report to the Maryland Environmental Crimes Unit that 200 drums containing hazardous waste were hidden among the thousands of empty drums. MDE discovered six suspected waste drums hidden underneath several piles of empty drums. Four of the drums contained multilayered flammable liquids; one of the drums contained corrosives and one drum did not exhibit the characteristic of flammability or corrosivity.

After evaluating the scope of the potential cleanup, MDE requested EPA assistance, and on April 1, 1991, the EPA Region III Superfund Removal Branch performed a removal assessment. The Removal Assessment team determined that the Site presented a direct contact threat to humans, a fire hazard, and a potential threat for additional releases of hazardous substances from leaking weathered drums. The EPA Regional Administrator authorized funding to mitigate the threat posed to human health and the environment on June 7, 1991.

2.3 Remedial Actions

On July 1, 1991, the EPA Technical Assistance Team and Environmental Technology, Inc. mobilized to the Site to begin removal activities. Site work was completed on May 28, 1992. A total of 23,733 drums were removed from the Site; 5,544 drums contained materials. Before removal, drums were sampled and analyzed to classify the waste. Sample analyses included Toxicity Characteristic Leaching Procedure volatiles (TCLP), TCLP semivolatiles (SVOCs), TCLP phenols, TCLP pesticides, oil and grease, pH, ignitability, flash point, polychlorinated biphenyls (PCBs) and cyanide. The number of drums and the hazard classifications are presented in Table 1.

Table 2: Inventory of Drums Drumco Drum Dump

Classification	Number	Hazardous
Corrosive Liquid Acid	**195**	**Yes**
Corrosive Liquid Base (CLB)	**175**	**Yes**
Corrosive Solid Acid (CSA)	**1**	**Yes**
Corrosive Solid Base (CSB)	**49**	**Yes**
Oxidizing Liquids (OL)	**35**	**Yes**
Oxidizing Solids (OS)	**4**	**Yes**
Flammable Liquids (FL)	**229**	**Yes**
Flammable Solids (FS)	**11**	**Yes**
Flammable Liquid/Oxidizers	**7**	**Yes**
Other Regulated Material (liquid)	**3066**	**Yes**
Other Regulated Material (solid)	**12**	**Yes**
Oil, Oily Water, Oily Sludge	**31**	**no**
Unregulated Materials	**1729**	**no**
Total	5544	

Analytical results from samples of drum wastes revealed concentrations of TCLP volatile organic compounds (VOCs), metals, acids and bases. Although discussed in the text of the Final Site Screening Inspection (Halliburton/NUS, 1993) as analytical suites of concern, it appears that analysis for pesticides and PCBs were not performed. Cyanide and sulfide were not detected.

In addition to waste classification of drum material, soil samples were also collected to characterize the impact of leaking drums on surface soils. Samples were collected using an unbiased grid soil pattern and analyzed for RCRA-regulated contaminants (VOCs, SVOCs, metals, oil and grease, corrosivity and extractable organic halides [EOX]). The Site was divided into 12 areas, and one composite sample was collected from each area. Each composite sample consisted of 13 individual soil samples taken from within each area. Soil analyses revealed two

areas of contamination: A 200-foot square area (Area 7) located in the southwest corner of the Site contained 850 parts per million (ppm) of EOX; and a 100-foot square area (Area 9) located in the southeast corner of the Site contained 3.3 ppm of leachable chromium.

Approximately 430 tons of soil were excavated from these two areas, 164 tons from Area 7 and 272 tons from Area 9, and transported off site to an approved RCRA facility. Confirmation sample results from the two areas varied: Area 7 – the EOX concentration was reduced from 850 ppm to 8 ppm; Area 9 – the chromium concentration increased from 3.39 ppm to 3.8 ppm. Consequently, the Area 9 excavation was capped with clean fill to mitigate the direct contact and ingestion threats.

MDE performed a preliminary assessment (PA) of the Drumco Site in December 1992. On April 14, 1993, Halliburton NUS and Gannett Flemming performed a Site Screening Inspection (SSI) and an SSI report for the Drumco Site was completed in November 1993.

3.0 ENVIRONMENTAL SETTING

3.1 Water Supply

Table 3 – Domestic Water Sources within a Four-Mile Radius of Site

RING DISTANCE FROM THE SITE	ESTIMATE NUMBER OF DOMESTIC WELLS	ESTIMATED POPULATION SERVED*	TOTAL POPULATION
0 – ¼ mile	(b) (9)		
¼ –½ mile			
½ - 1 mile			
1 – 2 miles			
2 – 3 miles			
3 – 4 miles			
Total			

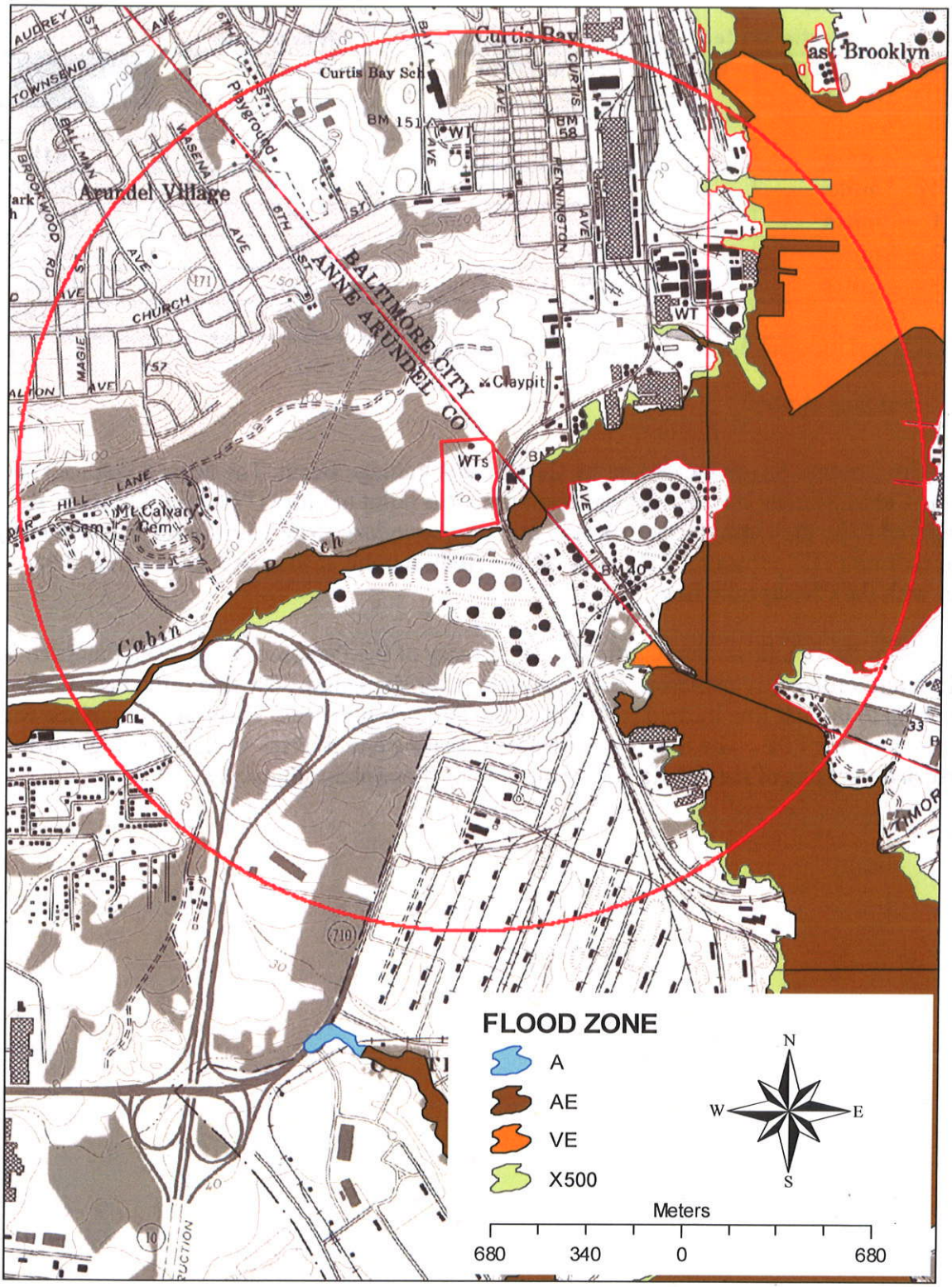
*According to 2000 U.S. Census data, the average population per household is 2.62.

3.2 Surface Water

The Drumco Site is located in the Curtis Bay Drainage Basin. The nearest surface water body is Cabin Branch; the furthest upstream probable point of entry (PPE) for this study is considered to be the Drumco southeastern property boundary. The 15-mile surface water target distance limit (TDL) from the PPE ends off the Bodkin point at the confluence of the Patapsco River with the Chesapeake Bay.

Cabin Branch flows into Curtis Bay, an estuary of the Patapsco River. The Patapsco is a tidal estuary utilized by numerous fish populations for spawning. The tide influences Cabin Branch up to the fall line located just west of the Drumco property. There are no surface water intakes along the PPE. The Site is bounded by estuarine and riverine wetlands along much of its course and portions of the site lie within the 10-year floodplain (Figure 11).

Figure 11: Flood Zones



A=100 year flood zone; AE=100 year flood zone w/BFE; VE=100 year flood zone w/velocity hazard; X500=500 year flood zone; X=outside 500 year flood zone; BFE=Base Flood Elevation

Figure 12: One Mile Radius Wetland Map

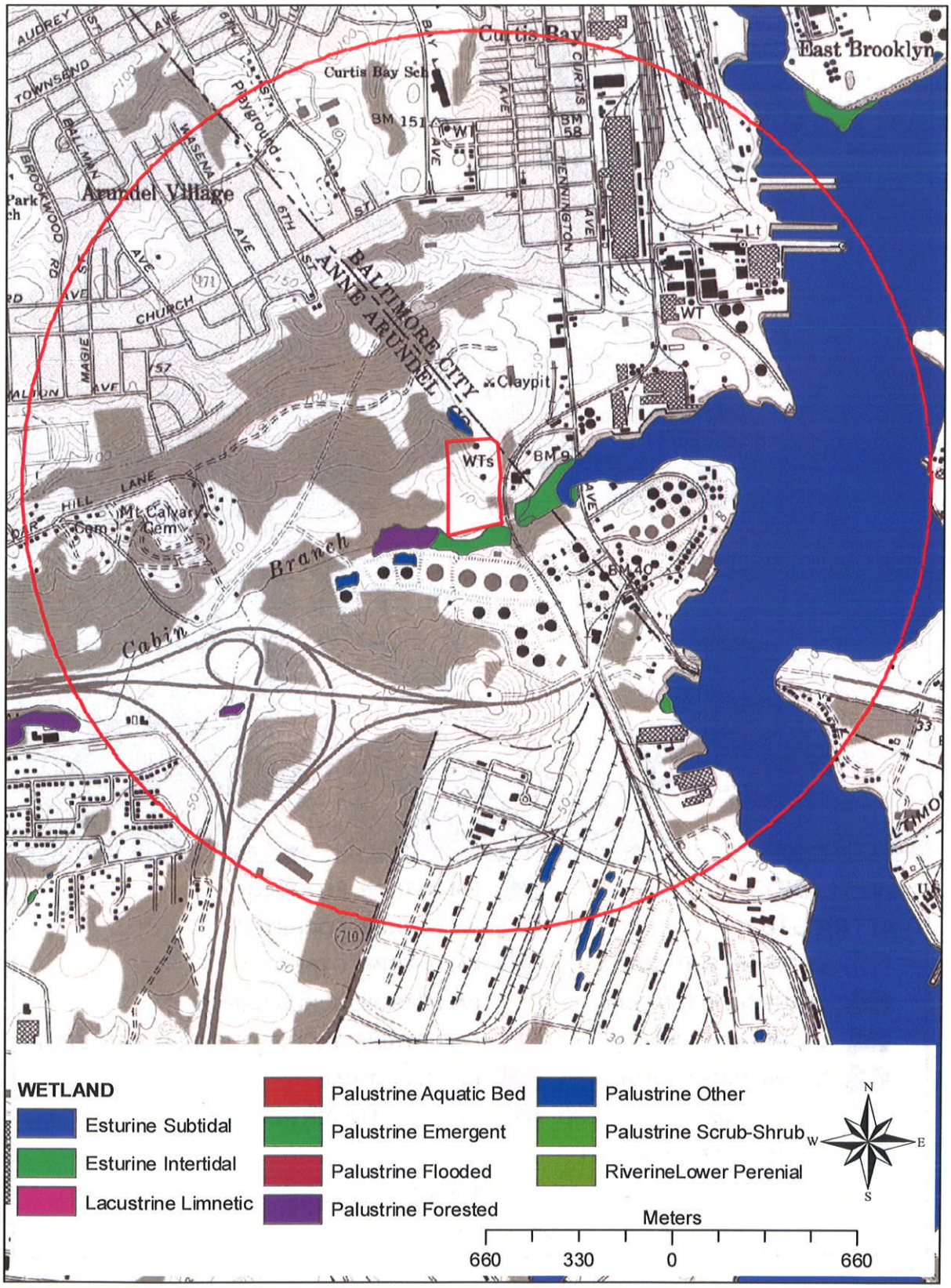
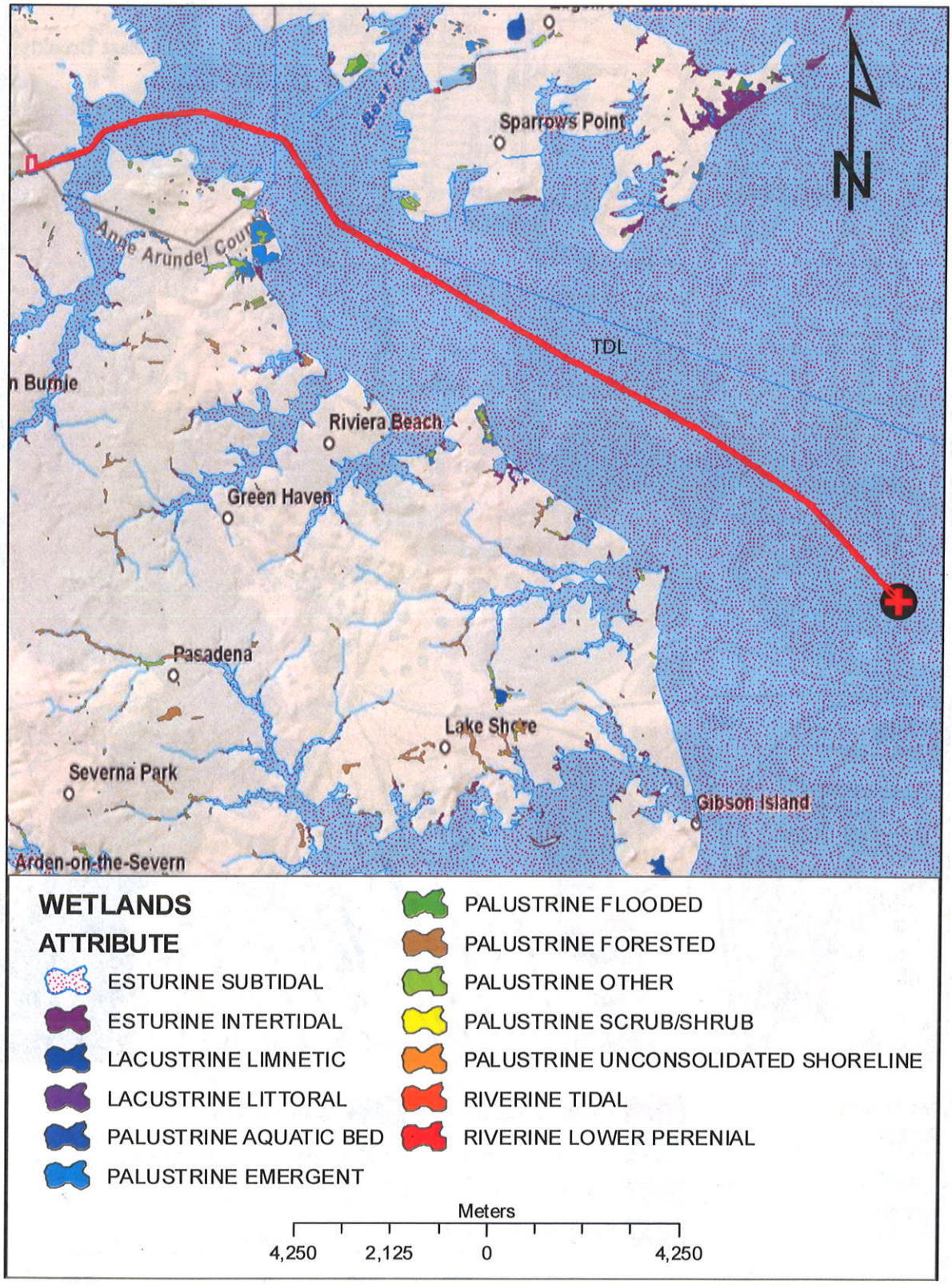


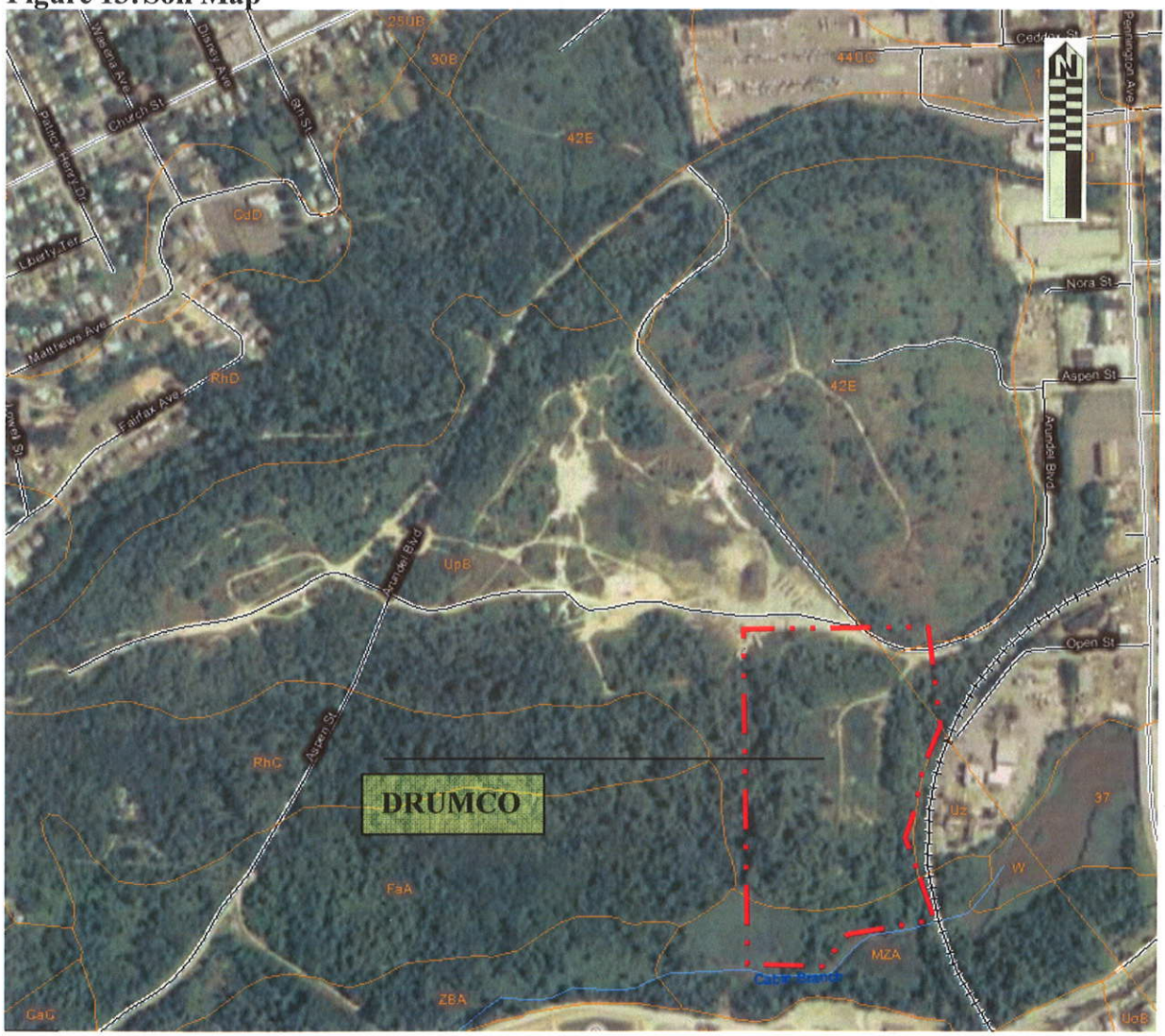
Figure 12A: Wetlands Along The 15 Mile TDL



3.3 Soils

The soils occurring on and in the vicinity of the site belong to the Udorthents and Mispillion soil series. The majority of the soil found at the Drumco Site are in the Udorthent series (UpB in Anne Arundel County and 42E in Baltimore City). These soils are well drained with a slight to moderate slope (0 to 35%) with the water table found generally less than six feet below ground surface. The remaining soils on the property are classed as Mispillion and Transquaking soils with a slope of less than one percent. These soils are very poorly drained and are very frequently flooded (Figure 13).

Figure 13: Soil Map



3.4 Geology and Groundwater

The Drumco site lies in the erosional remnants of the Coastal Plain Physiographic Province, near the Fall Line. The Coastal Plain Physiographic Province is characterized by a wedge-shaped series of layers of unconsolidated sediments, which dip eastwardly and become progressively thicker with distance, eventually reaching over 8,000 feet in thickness at Ocean City. Thickness of these sediments underlying the site and overlying Precambrian crystalline bedrock is estimated at approximately 150 to 200 feet, based on driller's logs.

The site is situated on artificial fill consisting of heterogeneous materials such as rock and brick fragments, gravelly sand and unconsolidated sediment. The top geological strata in the area of the site are Quaternary Lowland Deposits consisting of medium to coarse grained and varicolored gravels, sands, silts and clays. Below the surficial sediments are the Cretaceous strata of the Potomac Group. The Patapsco Formation, which is made up of sand and interbedded with layers of silty clay predominantly made up of quartz, illite and kaolinite, is known to be approximately 60 feet thick. The next layer is the Arundel Formation, which is a clay layer known to be approximately 140 feet thick, interbedded with lenses of sandy silt containing traces of lignitic material. The clay minerals are predominantly kaolinite and illite. The subsequent underlying strata is the Patuxent Formation and is made up of sand and gravel with interbedded lenses of silty clay with quartz as the predominant mineral. The Patuxent Formation is underlain by bedrock consisting of a complex assemblage of schist, gneiss and gabbro (Figure 14).

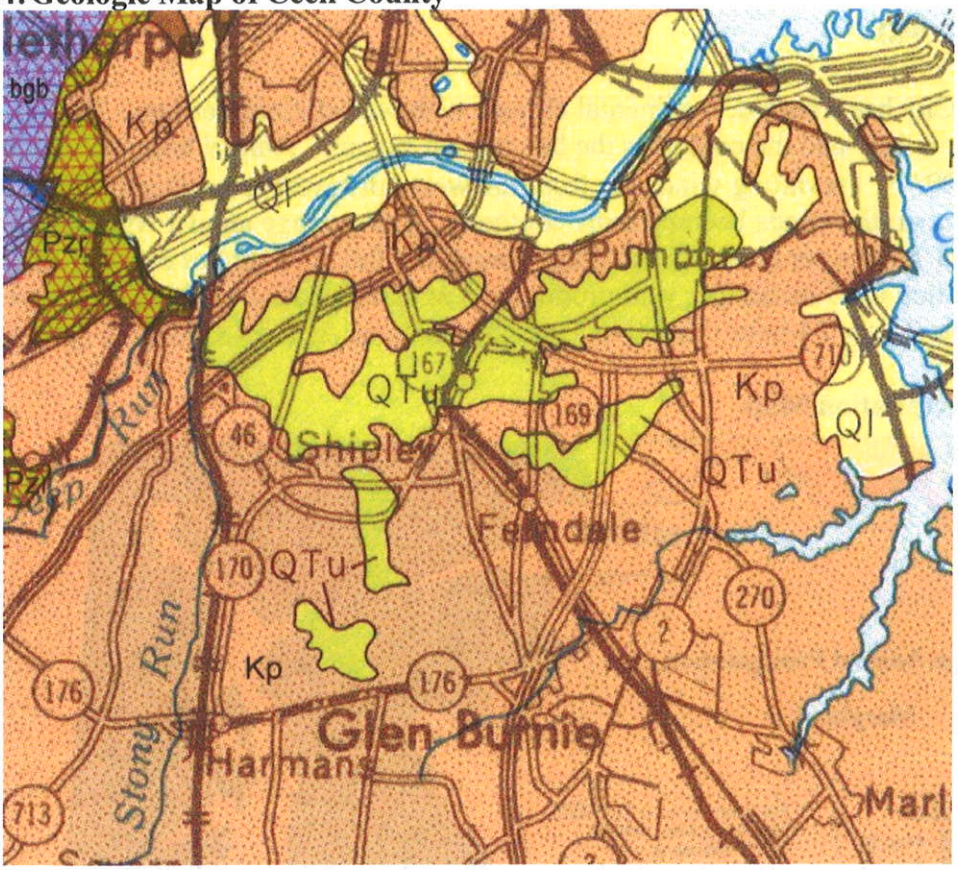
(b) (9)

[redacted]

Table 4: Wells in the Vicinity of DRUMCO Site

Distance	Domestic	Farm	Industrial	Production	Test
0 – 0.5	(b) (9) [redacted]				
0.5 – 1					
1 – 2					
2 – 3					
3 -- 4					

Figure 14: Geologic Map of Cecil County



Kp

Potomac Group - **Interbedded quartzose gravels; protoquartzitic to orthoquartzitic argillaceous sands; and white, dark gray and multicolored silts and clays; thickness 0 to 800 feet.**

Raritan and Patapsco Formations - **Gray, brown, and red variegated silts and clays; lenticular, cross-bedded, argillaceous, subrounded sands; minor gravels; thickness 0 to 400 feet.**

Arundel Clay - **Dark gray and maroon lignitic clays; abundant siderite concretions; present only in Baltimore-Washington area; thickness 0 to 100 feet.**

Patuxent Formation - **White or light gray to orange-brown, moderately sorted, cross-bedded, argillaceous, angular sands and subrounded quartz gravels; silts and clays subordinate, predominately pale gray; thickness 0 to 250 feet.**

Ql

Lowland Deposits - **Gravel, sand, silt and clay. Medium- to coarse-grained sand and gravel; cobbles and boulders near base; commonly contains reworked Eocene glauconite; varicolored silts and clays; brown to dark gray lignitic silty clay; contains estuarine to marine fauna in some areas; thickness 0 to 150 feet.**

QTu

Upland Deposits (Western Shore) - **Gravel and sand, commonly orang-brown, locally limonite-cemented; minor silt and red, white, or gray clay; lower gravel member and upper loam member in Southern Maryland; thickness 0 to 50 feet.**

3.5 Meteorology

Baltimore City has a humid, continental climate with well-defined seasons. The warmest part of the year is July and the coldest is the last part of January. Annual temperatures range from 90° F to 20° F. Prevailing winds are from the west-northwest to northeast. From May through September, the winds become more southerly. The average annual wind speed is approximately 10 miles per hour. The average annual rainfall is 43 inches per year and the annual evaporation is 35 inches per year producing a net precipitation of 8 inches per year (Figure 15). The 2-year 24-hour rainfall is 3.0 inches in Anne Arundel County (Figure 16).

Figure 15: Precipitation Map

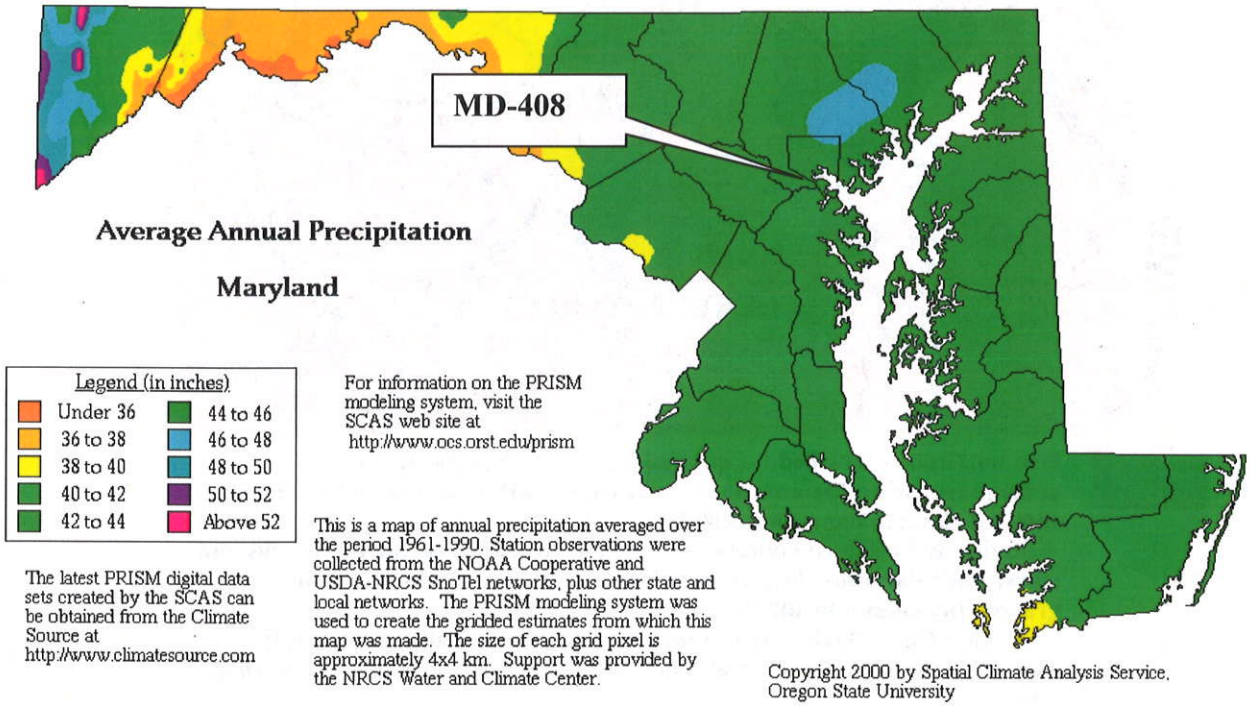
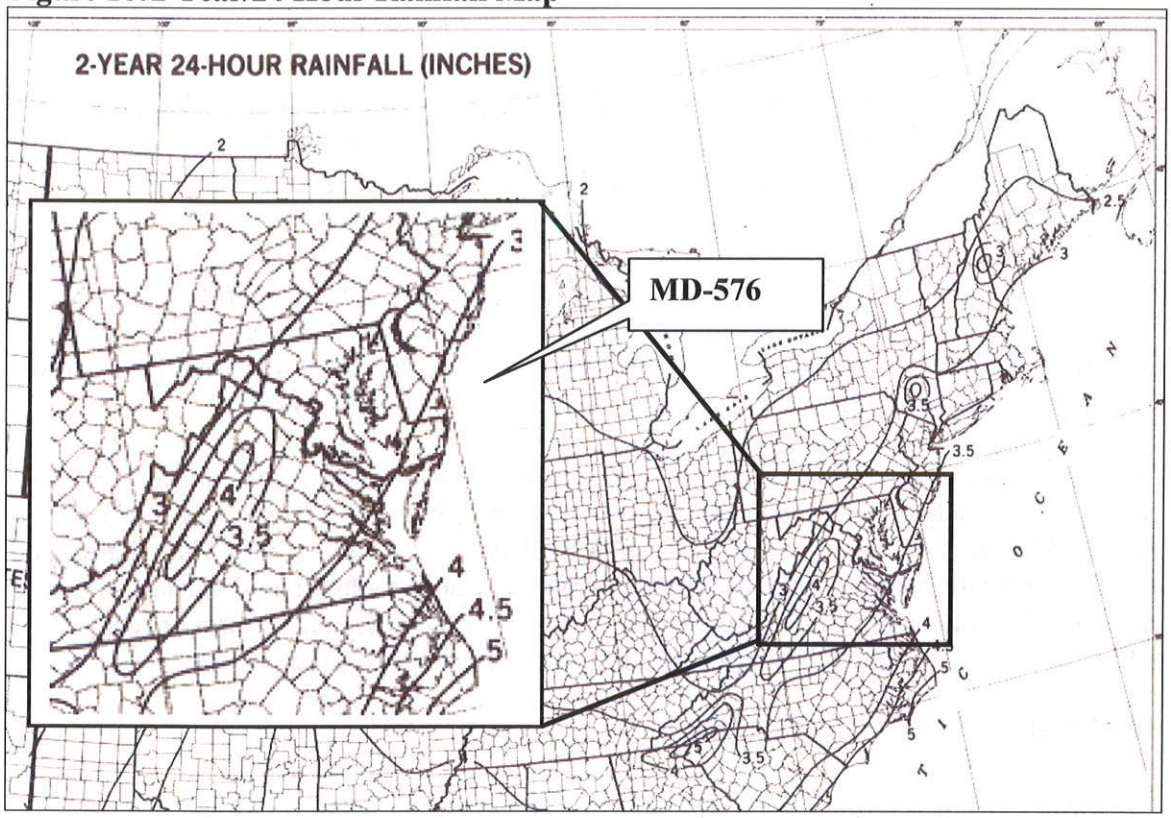


Figure 16: 2 Year/24 Hour Rainfall Map



3.6 Nearby Land Use and Population Distribution

The Drumco site is located in a mixed residential/industrial area in the urbanized Baltimore metropolitan area (Figure 9). The population within a 4-mile radius of the site is outlined in Table 5.

Table 5: Population Distribution Within 4-Miles of the Site

Distance from the site (miles)	Estimated Population from 2000 Census
0 – 1/4	167
1/4 – 1/2	618
1/2 – 1	6,390
1 – 2	23,507
2 – 3	24,007
3 – 4	42,464
Total	**97,153**

4.0 WASTE DESCRIPTION

On July 1, 1991, the EPA Technical Assistance Team and Environmental Technology, Inc. mobilized to the Site to begin removal activities. 5,544 drums contained hazardous materials including corrosive solids and liquids (acid and base), oxidizing agents, flammable compounds and other regulated material not otherwise specified (NOS).

The tanning industry typically uses chemicals for dehairing, liming, deliming, tanning and curing. A partial list of chemicals common in tanning the industry includes: trivalent chromium sulfate, sodium bicarbonate, sodium sulfide or sodium sulfhydrate, arsenic or cyanide as sharpening agents, ammonium sulfate, sulfuric acid, lime, and aniline dyes.

Additional chemicals of concern (COCs) described at other tanning sites on the National Priorities List (NPL) such as the Winchester Tannery Site in Winchester, Cheshire County, New Hampshire; the Mohawk Tannery facility in Nashua, Hillsborough County, New Hampshire; and the Pownal Tanning Site in the Village of North Pownal, Vermont include: acid wastes, methylene chloride, caustic substances, cadmium, lead, pentachlorophenol, chlorobenzene, trichloroethylene, polychlorinated biphenyls (PCBs), dioxins and chromium sludges.

5.0 PREVIOUS INVESTIGATIONS

The former Drumco Drum Dump Site was first inspected by MDE on September 26, 1990 in response to several complaints of hazardous materials being stored on the Site. Leaking drums of caustic materials were discovered in a trailer used for drum storage and evidence of soil contamination from drum spillage was observed. The drums were subsequently removed by MDE for proper off-site disposal; the operator of the facility, Mr. George Garratt was advised to clean up the storage yard.

During an inspection of the facility on January 12, 1991, MDE observed that Site conditions had deteriorated. Drums were stored chaotically throughout the Site and spillage from drums was evident. MDE issued a formal complaint and order to Drumco Inc., on January 21, 1991, for violations of Maryland water control and solid waste management laws. Mr. George Garratt was subsequently found guilty and was sentenced to 90 days in jail and fined $50,000 for violations of Maryland Environmental Laws.

In March 1991, MDE investigated the Drumco Site in response to a report to the Maryland Environmental Crimes Unit that 200 drums containing hazardous waste were hidden among the thousands of empty drums. MDE discovered six suspected waste drums hidden underneath several piles of empty drums. Four of the drums contained multilayered flammable liquids; one of the drums contained corrosives and one drum did not exhibit the characteristic of flammability or corrosivity.

After evaluating the scope of the potential cleanup, MDE requested EPA assistance, and on April 1, 1991, the EPA Region III Superfund Removal Branch performed a removal assessment. The Removal Assessment team determined that the Site presented a direct contact threat to humans, a fire hazard, and a potential threat for additional releases of hazardous

substances from leaking weathered drums. The EPA Regional Administrator authorized funding to mitigate the threat posed to human health and the environment on June 7, 1991.

On July 1, 1991, the EPA Technical Assistance Team and Environmental Technology, Inc. mobilized to the Site to begin removal activities. Site work was completed on May 28, 1992. A total of 23,733 drums were removed from the Site; 5,544 drums contained materials. MDE performed a preliminary assessment (PA) of the Drumco Site in December 1992.

On April 14, 1993, Halliburton NUS and Gannett Flemming performed a Site Screening Inspection (SSI) and an SSI report for the Drumco Site was completed in November 1993.

6.0 FIELD OPERATIONS

6.1 Contract Laboratory Protocol (CLP) Sampling

EPA Region III approved the SI Sampling and Analyses Plan on April 8, 2010. Sampling was conducted beginning on June 6, 2010 in accordance with the plan and the procedures outlined in EPA's CLP Routine Analytical Services Case Number CT4934, Deliverable Analytical Service Case Number R33452 (for hexavalent chromium analyses) and MDE's Standard Operating Procedures document.

The scope of this SI evaluates the potential impacts from operations at the Drumco facility on the soil and groundwater on site. Fifteen surface and twenty-four subsurface soil samples, fifteen groundwater samples, four surface water samples and four sediment samples (including duplicates, matrix spike and matrix spike duplicates), a field blank and trip blank were collected and submitted for analysis in accordance with the CLP Routine Analytical Services and were analyzed for TAL inorganics and TCL organics. History of the facility indicated the potential for hexavalent chromium contamination therefore Special Analytical Services were requested for hexavalent chromium analyses using EPA method 218.6. CLP protocol was followed throughout the sample collection and submittal process (U.S. EPA, "Contract Laboratory Program Guidance For Field Samplers," July 2007) for those samples that apply. The quality control used by MDE includes the submittal of a field duplicate for each matrix, as defined above. In addition, a solid and aqueous matrix spike sample was collected at specified additional volumes for CLP matrix spike quality control procedures. The sampling rationale and analytes are outlined in Table 6. The actual sampling locations are shown in Figure 17.

Table 6: Sample Table

Sample ID	Sample Type	Sample Location Rationale	Analytes
SB-01-00	Surface Soil	Area Background; MS/MSD	Metals, SVOC, Pesticides, PCBs and CR+6
SB-01-05	Subsurface Soil	Area Background	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SB-02-00	Surface Soil	Stressed Vegetation Area / Former Drum Location	Metals, SVOC, Pesticides, PCBs and CR+6
SB-02-05	Subsurface Soil	Characterize Vertical Migration of Waste	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SB-02-16	Subsurface Soil	Characterize Tannery Plant Soils	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SB-03-00	Surface Soil	Stressed Vegetation Area	Metals, SVOC, Pesticides, PCBs and CR+6
SB-03-10	Subsurface Soil	Characterize Vertical Migration of Waste	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SB-03-28	Subsurface Soil	Characterize Tannery Plant Soils	Metals, SVOC, Pesticides, PCBs and CR+6
SB-04-00	Surface Soil	Stressed Vegetation Area / Former Drum Location	Metals, SVOC, Pesticides, PCBs and CR+6
SB-04-08	Subsurface Soil	Characterize Vertical Migration of Waste	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SB-04-17	Subsurface Soil	Characterize Tannery Plant Soils	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SB-05-00	Surface Soil	Stressed Vegetation Area / Former Drum Location	Metals, SVOC, Pesticides, PCBs and CR+6
SB-05-08	Subsurface Soil	Characterize Vertical Migration of Waste	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SB-05-15	Subsurface Soil	Characterize Vertical Migration of Waste	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SB-06-00	Surface Soil	Stressed Vegetation Area / Former Drum Location	Metals, SVOC, Pesticides, PCBs and CR+6
SB-06-19	Subsurface Soil	Characterize Vertical Migration of Waste	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SB-06-29	Subsurface Soil	Characterize Tannery Plant Soils	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SB-07-08	Subsurface Soil	Characterize Vertical Migration of Waste	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SB-08-00	Surface Soil	Disturbed Area	Metals, SVOC, Pesticides, PCBs and CR+6
SB-10-00	Surface Soil	Characterize Potential Fill from Former Tannery Demolition	Metals, SVOC, Pesticides, PCBs and CR+6
SB-10-23	Subsurface Soil	Characterize Potential Fill from Former Tannery Demolition	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SB-11-00	Surface Soil	Characterize Tannery Sedimentation/Sludge Basin	Metals, SVOC, Pesticides, PCBs and CR+6
SB-11-02	Surface Soil	Characterize Tannery Sedimentation/Sludge Basin	Metals, SVOC, Pesticides, PCBs and CR+6
SB-12-00	Surface Soil	Characterize Tannery Potential Sludge Disposal Area	Metals, SVOC, Pesticides, PCBs and CR+6
SB-13-12	Subsurface Soil	Characterize Tannery Potential Sludge Disposal Area	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SB-14-50	Subsurface Soil	Characterize Former Tannery Lagoon*	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SB-15-13	Subsurface Soil	Characterize Former Tannery Lagoon*	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SB-15-29	Subsurface Soil	Characterize Tannery Drum Storage Area	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SB-16-00	Surface Soil	Duplicate of SB-05-00	Metals, SVOC, Pesticides, PCBs and CR+6
SB-16-05	Subsurface Soil	Duplicate of SB-02-16	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
GW-03-00	Surface Soil	Characterize Soil at GW-03 Boring	Metals, SVOC, Pesticides, PCBs and CR+6
GW-04-11	Subsurface Soil	Characterize Soil at GW-04 Boring	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
GW-05-01	Surface Soil	Characterize Soil at GW-05 Boring	Metals, SVOC, Pesticides, PCBs and CR+6
GW-07-06	Subsurface Soil	Characterize Soil at GW-07 Boring	Metals, VOC, SVOC, Pesticides, PCBs and CR+6

Sample ID	Sample Type	Sample Location Rationale	Analytes
GW-09-09	Subsurface Soil	Characterize Soil at GW-09 Boring	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
GW-11-01	Surface Soil	Characterize Soil at GW-11 Boring	Metals, SVOC, Pesticides, PCBs and CR+6
GW-11-04	Subsurface Soil	Characterize Soil at GW-11 Boring	Metals, SVOC, Pesticides, PCBs and CR+6
GW-12-11	Subsurface Soil	Characterize Soil at GW-12 Boring	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SED-01	Sediment	Sediment Background Location	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SED-02	Sediment	Sediment Migration along Property Boundary	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SED-03	Sediment	Sediment Migration Downgradient of Property	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SED-04	Sediment	Duplicate of SED-02	Metals, VOC, SVOC, Pesticides, PCBs and CR+6
SW-01	SW / Dissolved	Cabin Creek Surface Water Background Location; MS/MSD	Metals, VOC, SVOC, Pesticides/PCBs
SW-02	SW / Dissolved	Cabin Creek Surface Water Migration along Property Boundary	Metals, VOC, SVOC, Pesticides/PCBs
SW-03	SW / Dissolved	Cabin Creek Surface Water Migration Downgradient of Property	Metals, VOC, SVOC, Pesticides/PCBs
SW-04	SW / Dissolved	Duplicate of SW-02	Metals, VOC, SVOC, Pesticides/PCBs
GW-01	GW / Dissolved	Ground Water Background Location; N Central portion of the Site	Metals, VOC, SVOC, Pesticides/PCBs
GW-02	GW / Dissolved	Characterize Ground Water North Central Area of Site: Former Drums	Metals, VOC, SVOC, Pesticides/PCBs
GW-03	GW / Dissolved	Characterize Downgradient Groundwater to West of Site	Metals, VOC, SVOC, Pesticides/PCBs
GW-04	GW / Dissolved	Characterize Downgradient Groundwater to East of Site	Metals, VOC, SVOC, Pesticides/PCBs
GW-05	GW / Dissolved	Characterize Downgradient Groundwater to South of Site	Metals, VOC, SVOC, Pesticides/PCBs
GW-06	GW / Dissolved	Characterize Ground Water Central Portion of Site: Former Drums	Metals, VOC, SVOC, Pesticides/PCBs
GW-07	GW / Dissolved	Characterize Upgradient Groundwater in NW portion of Site	Metals, VOC, SVOC, Pesticides/PCBs
GW-08	GW / Dissolved	Characterize Upgradient Groundwater in central NE portion of Site	Metals, VOC, SVOC, Pesticides/PCBs
GW-09	GW / Dissolved	Characterize Downgradient Groundwater in S of Lagoon	Metals, VOC, SVOC, Pesticides/PCBs
GW-10	GW / Dissolved	Characterize Downgradient Groundwater in SE portion of Site	Metals, VOC, SVOC, Pesticides/PCBs
GW-11	GW / Dissolved	Characterize Groundwater in Sedimentation Basin; SW portion of Site	Metals, VOC, SVOC, Pesticides/PCBs
GW-12	GW / Dissolved	Ground Water Background Location, NE portion of Site	Metals, VOC, SVOC, Pesticides/PCBs
GW-13	GW / Dissolved	Characterize Downgradient Groundwater to West of Site	Metals, VOC, SVOC, Pesticides/PCBs
GW-14	GW / Dissolved	Characterize Groundwater at Former Lagoon*	Metals, VOC, SVOC, Pesticides/PCBs
GW-15	GW / Dissolved	Duplicate of GW-06	Metals, VOC, SVOC, Pesticides/PCBs
GW-16	Groundwater	Field Blank - Day 1	Metals, VOC, SVOC, Pesticides/PCBs
GW-17	Groundwater	Field Blank - Day 2	Metals, VOC, SVOC, Pesticides/PCBs
GW-18	Groundwater	Field Blank - Day 3	Metals, VOC, SVOC, Pesticides/PCBs
GW-21	Groundwater	Characterize Groundwater (Petroleum Odor)	VOC
GW-22	Groundwater	Characterize Groundwater (Petroleum Odor)	VOC
GW-23	Groundwater	Characterize Groundwater (Petroleum Odor)	VOC
TB-01	Groundwater	Trip Blank - Day 1	VOC
TB-02	Groundwater	Trip Blank - Day 2	VOC

Sample ID	Sample Type	Sample Location Rationale	Analytes
TB-03	**Groundwater**	**Trip Blank - Day 3**	**VOC**

Note: N - Normal Sample MS - Matrix Spike SW - Surface water MSD- Matrix Spike Duplicate; Dup - Duplicate
QA/QC - Quality Assurance/Quality Control * Requested by WHD Properties GW - Groundwater

Figure 17: Proposed Soil and Groundwater Sampling Locations

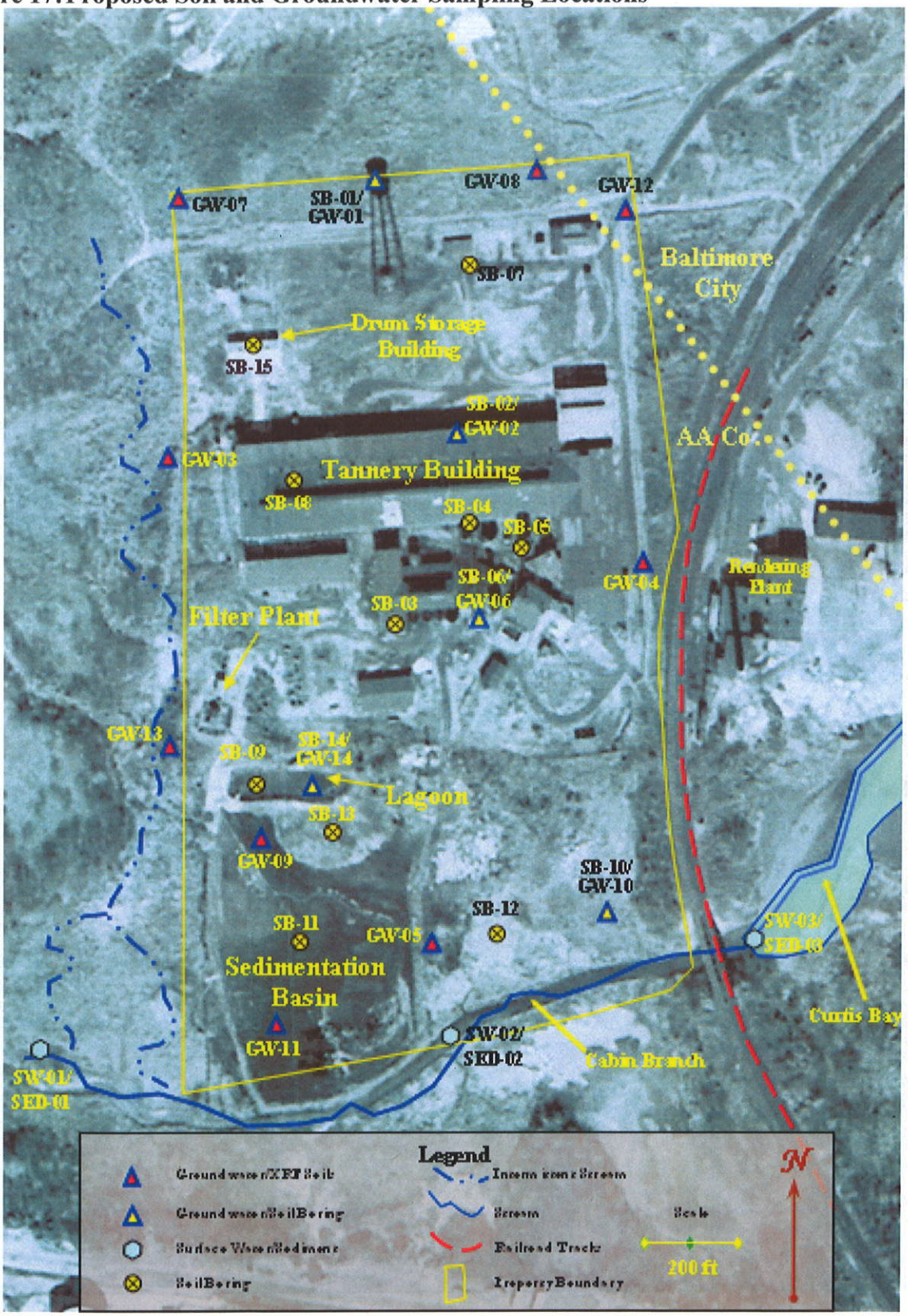


Figure 18: Groundwater and Surface Water Sampling Locations

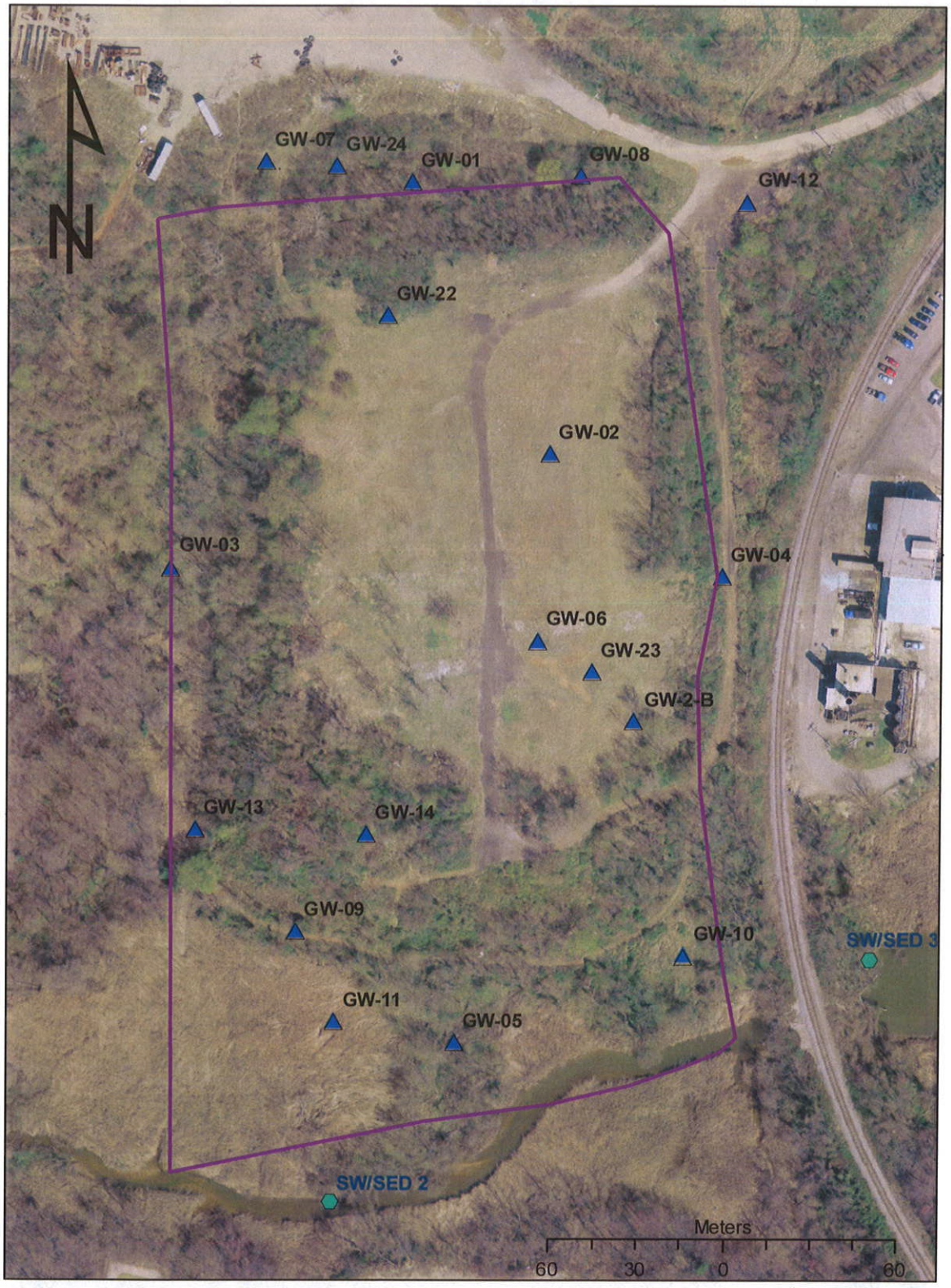


Figure 19: Soil Sampling Locations

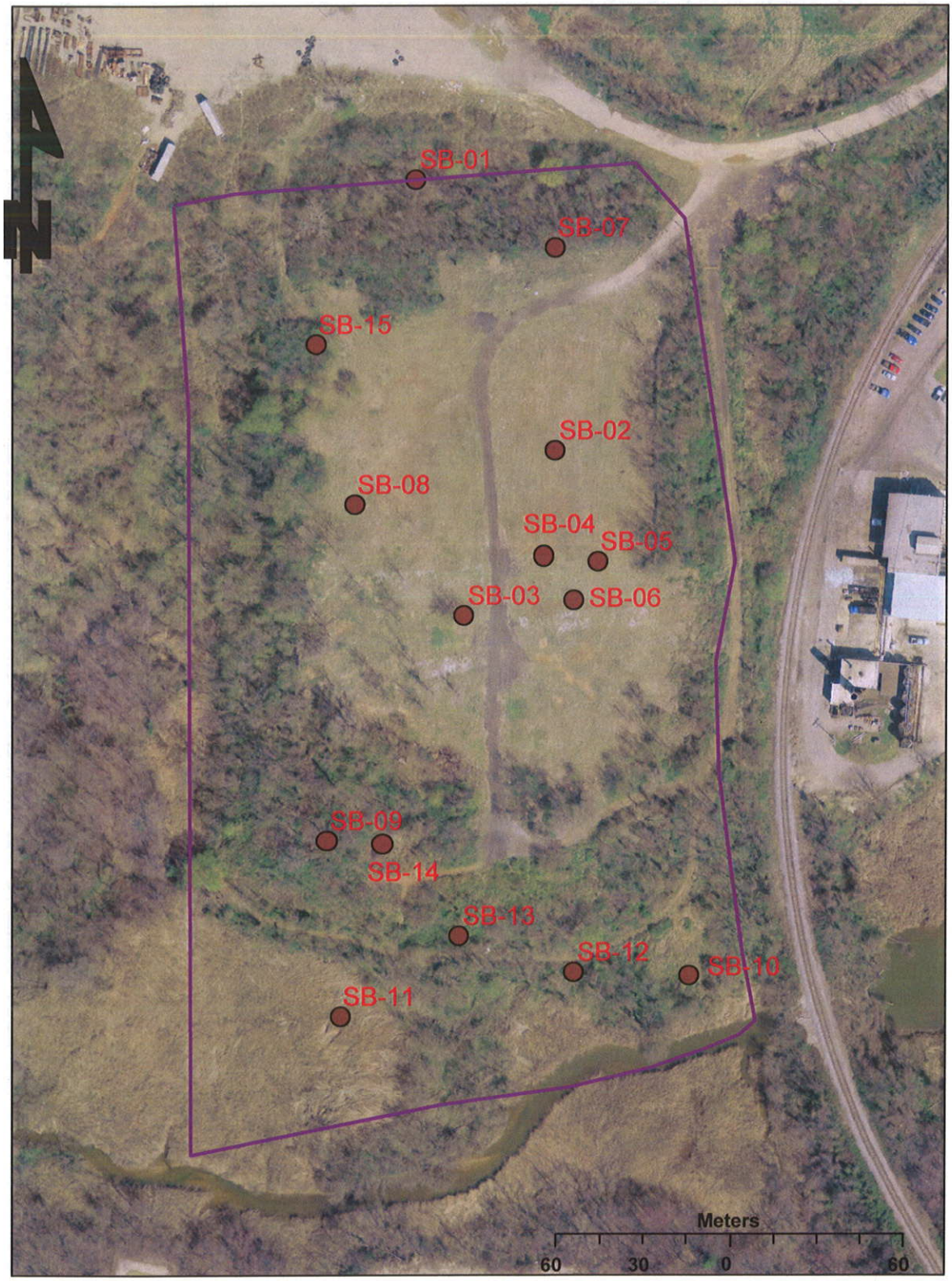


Figure 20: Drumco Site Sampling Locations

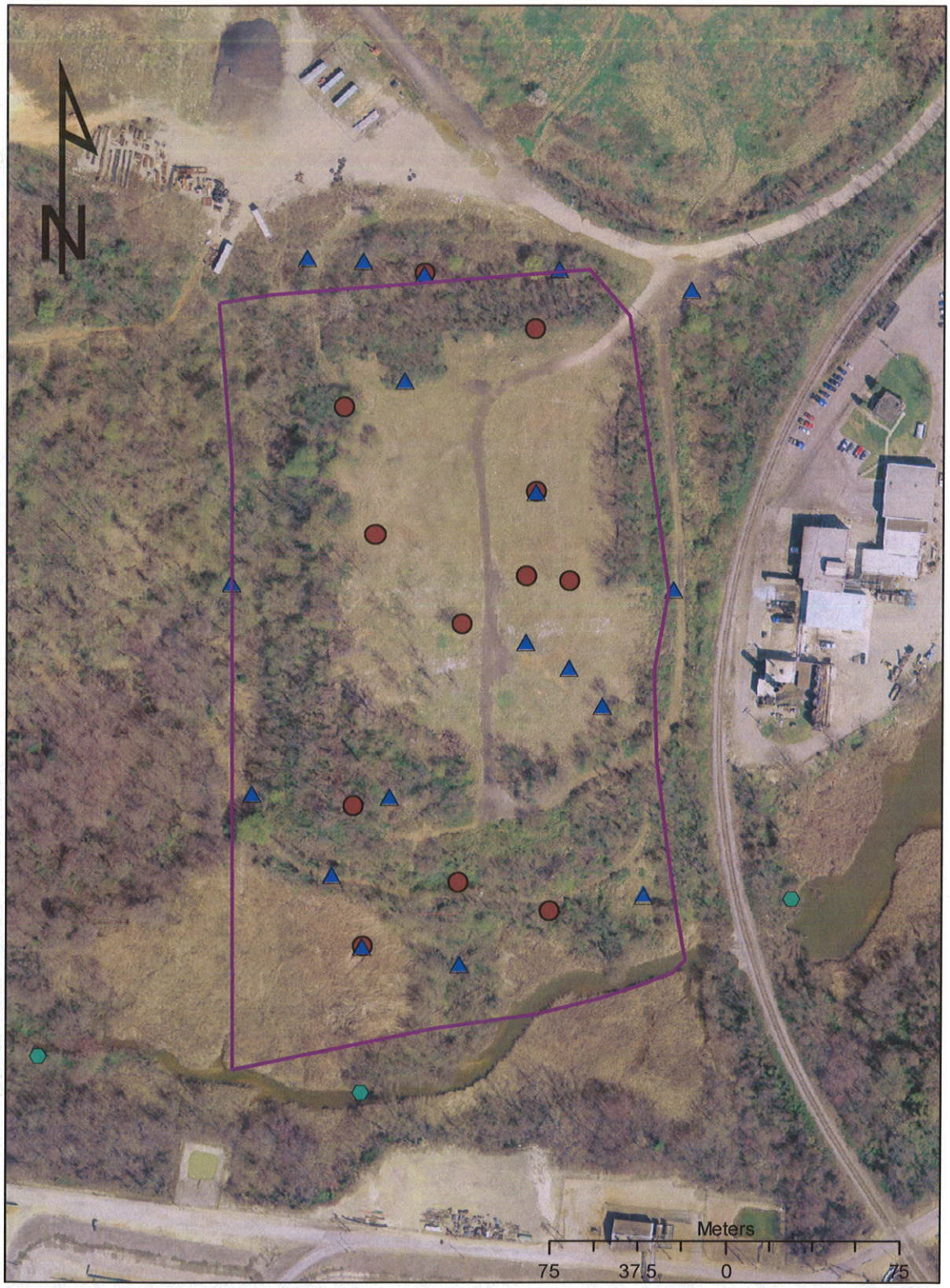


Table 7: Sampling Location Coordinates

STATION	N LATITUDE	E LONGITUDE
SW/SED 1	39° 12.709'	76° 35.621
SW/SED 2	39°12.700'	76° 35.525'
SW/SED 3	39° 12.745	76° 35.396
GW-01	39° 12.891	76° 35.505
GW-02	39° 12.840	76° 35.472
GW-03	39° 12.819	76° 35.563
GW-04	39° 12.817	76° 35.431
GW-05	39° 12.730	76° 35.495
GW-06	39° 12.805	76° 35.475
GW-07	39° 12.895	76° 35.540
GW-08	39° 12.892	76° 35.465
GW-09	39° 12.751	76° 35.533
GW-10	39° 12.746	76° 35.440
GW-11	39° 12.734	76° 35.524
GW-12	39° 12.887	76° 35.425
GW-13	39° 12.770	76° 35.557
GW-14	39° 12.769	76° 35.516
GW-22	39° 12.866	76° 35.511
GW-23	39° 12.799	76° 35.462
GW-24	39° 12.894	76° 35.523
GW-2-B	39° 12.790	76° 35.452
SB-01	39° 12.891	76° 35.505
SB-02	39° 12.840	76° 35.472
SB-03	39° 12.809	76° 35.494
SB-04	39° 12.826	76° 35.475
SB-05	39° 12.819	76° 35.462
SB-07	39° 12.878	76° 35.472
SB-08	39° 12.830	76° 35.520
SB-09	39° 12.767	76° 35.527
SB-11	39° 12.734	76° 35.524
SB-12	39° 12.742	76° 35.468
SB-13	39° 12.749	76° 35.517
SB-17	39° 12.860	76° 35.529

7.0 CLP ANALYTICAL RESULTS

7.1 Groundwater Sampling Results

MDE installed eighteen temporary one inch piezometers, including a background piezometer, across the site at the first water bearing zone via Geoprobe ® technology. The piezometers were designated GW-1 through 14. GW-1 was installed north of the property in an area unaffected by the Drumco operation. The first saturated zone was encountered at approximately 32 feet bgs in a maroon/dark red sandy layer and the piezometer was screened at 28 to 38 feet bgs. The piezometer was purged for several minutes until water ran clear. Temporary well GW-2 was located in the center of the historic tannery; the well was set in a black sandy silt and screened from 22 to 36 feet below ground surface (bgs). GW-03 was located on the western edge of the site; the well was screened in a light brown poorly sorted fine to coarse sand at 10 to 20 feet bgs. GW-04 was set on the eastern edge of the property in a layer of mixed debris and wet black sand interspaced with layers of wet tan sand; the well was screened from 19 to 29 feet bgs. GW-05 was set on the southern edge of the property off the old perimeter haul road that borders Cabin Branch. This was a very shallow well set at five feet bgs in a wet dark gray soft sandy clay layer. GW-06 was set in the vicinity of the southeastern edge of the old tannery building complex. This well was set at 39 feet bgs in a wet silty material which graded from black to gray to tan natural sand. GW-07 was located on the northwestern corner of the property and was set at 54 feet bgs in a wet tan silty sand layer. GW-08 was located on the northeastern edge of the property and was set in a wet white sand at 49.5 feet bgs. GW-09 was located in the southwestern quadrant of the property and was set in a wet brown to tan sandy silt at 15 feet bgs. GW-10 was located on the southeastern corner of the site and was set at 37 feet bgs in a wet black layer. GW-11 was located on the southwestern edge of the property just north of Cabin Branch. GW-11 was set at five feet bgs in a dark greenish-gray soil mottled with dark brown silty clay. GW-12 was located on the northern edge of the property just east of the access road entrance to the site. This piezometer was set at 48 feet bgs in a wet tan sand layer. GW-13 was located on the western edge of the property, just west of the historic lagoon. The piezometer was set in a gray silty material at 16 feet bgs. GW-14 was located on the eastern end of the old treatment lagoon. GW-14 was set at 55 feet bgs in a layer of wet black silty material that graded to gravel over a tan silty sand layer. Three additional temporary wells, labeled GW-22, GW-23 and GW-24, were installed for this investigation. GW-22 was set in a wet sand layer at 48 feet bgs, and GW-23 was set at 43 feet bgs in a wet gray sand layer. GW-24 was located in the vicinity of the historic sedimentation basin. (Figures 17 and 18).

As shown in Tables 8, inorganic contamination was detected in levels greater than MDE June 2008 Cleanup Standards for Type I Aquifers and/or November 2010 EPA Risk-Based Concentrations (RBCs) throughout the unfiltered groundwater samples. Arsenic was detected in all samples in levels greater than the regulatory guidelines. Chromium was found in levels greater than regulatory guidelines and significantly above background in GW-5 and GW-11. Both samples were obtained from the vicinity of the historic tannery's settling pond. Lead was found in levels above regulatory guidelines in all samples. Lead was identified in levels significantly greater than background in GW-3, GW-6, GW-9, GW-10, GW-14 and GW15, the GW-6 duplicate. The samples collected from GW-6 and GW-10 contained lead at levels that were an order of magnitude greater than background.

The data in Table 9 shows significant elevations in the dissolved phase of several inorganic contaminants across much of the site. Arsenic was detected in levels above regulatory standards in all but three well samples; arsenic was not detected in wells GW-9, GW-11 and GW-14. Arsenic, cobalt, iron and manganese were elevated in filtered samples obtained from GW-1, GW-2, GW-3, GW-7, GW-8 and GW-12. All of these wells were located on the northern extreme of the property. Aluminum and manganese were still present at levels above MDE Cleanup Standards and/or RBCs in the filtered samples. Barium was detected at levels significantly greater than background in wells GW-2, GW-4, GW-6, GW-10, GW-13, GW-14 and GW-15, the duplicate sample of GW-6. Chromium was also detected in the dissolved phase in significant levels in GW-2, GW-5, GW-6, GW-10, GW-11, GW-13 and GW-15, the duplicate of GW-6.

As shown in Tables 10, 11 and 12, low levels of VOCs, SVOCs, pesticides and PCBs were detected in the groundwater samples. Benzene was detected in six samples at levels significantly above background and the regulatory standards (GW-2,GW-6, GW-7, GW-10, GW-13, GW-15, GW-22 and GW-23). All benzene detections were adjacent to historic locations of site access roads. The samples obtained from GW-2 exhibited the highest levels of benzene and significant levels of seven SVOCs and seven different pesticides. This sample was collected from the center of the site downgradient of the historic Drumco drum storage yard.

Table 8: Detected Inorganics in Groundwater Samples

Detected Analytes (µg/L)	MDE Cleanup Standards	EPA RBC/MCL (tap water)	GW-1 BACKGROUND	GW-2	GW-3	GW-4	GW-6	GW-7	GW-12	GW-15 (dup GW-6)
ALUMINUM	50	37,000	41700	17600 L	75300 K	14200 L	86300 L	22500	48800	88500 L
ANTIMONY	6	15	4.0 J	12.9 J	ND	9.7 J	19.4 J	3.5 J	3.7 J	20.4 J
ARSENIC	10	.045	149	48.1 L	38.0	19.9 L	187 L	112	77.7	199 L
BARIUM	2,000	2,000*	320	886 L	512	914 L	2190 L	277	343	2180 L
BERYLLIUM	4	4*	ND	0.68 J	ND	1.1 J	6.4 L	ND	ND	6.0 L
CADMIUM	5	5*	ND	2.2 J	8.8	4.2 J	26.9 L	ND	0.81 J	30.6 L
CALCIUM	--	--	ND	241000 L	113000	293000 L	219000 L	ND	ND	207000 L
CHROMIUM	100	100*	647	3160 L	415	211 L	2780 L	351	584	2790 L
COBALT	--	11	38.2 J	34.4 J	37.2 J	13.4 J	128 L	63.1	39.9 J	133 L
COPPER	1,300	1,500	ND	ND	ND	ND	ND	ND	ND	ND
IRON	300	26,000	165000	101000 L	141000	70200 L	281000 L	85800	165000	266000 L
LEAD	15	15 (MCL)	126 K	327 J	725	320 J	1840 J	117 K	236 K	2080 J
MAGNESIUM	--	--	53300	683000 L	294000	281000 L	502000 L	112000	47200	488000 L
MANGANESE	50	880	1600	569 L	1970	784 L	2660 L	1640	1400	2440 L
MERCURY	2	0.57	0.17 J	0.39 L	0.95	1.3 L	3.3 L	0.46	0.74	3.6 L
NICKEL	73	730	101	888 L	114	119 L	500 L	53.8	81.2	493 L
POTASSIUM	--	--	ND	123000 J	24000 J	37700 J	101000 J	ND	ND	98500 J
SELENIUM	50	50*	ND	ND	2.9 J	ND	ND	ND	ND	ND
SILVER	100	180	ND	ND	ND	ND	3.2 J	ND	ND	3.6 J
SODIUM	--	--	ND	516000 L	104000	ND	492000 L	ND	ND	484000 L
THALLIUM	2	2*	ND	ND	16.8 J	ND	ND	ND	ND	ND
VANADIUM	3.7	2.6	437	96.1 L	228	58.3 L	430 L	318	539	415 L
ZINC	1,100	11,000	515	1640 L	1450	1630 L	6100 L	402	186	5900 L
CYANIDE	200	200*	ND	11.9 L	5.3 J	10.5 L	22.6 L	ND	ND	35.5 L

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. * - MCL; Analytes highlighted in yellow exceed November 2010 EPA or MDE SCS standards. Red indicates significant; --: MDE or EPA has not established Cleanup Standards

Table 8 (Cont.): Detected Inorganics in Groundwater Samples

Detected Analytes (µg/L)	MDE Cleanup Standards	EPA RBC (tap water)	GW-1 BACKGROUND	GW-5	GW-8	GW-9	GW-10	GW-11	GW-13	GW-14
ALUMINUM	50	37,000	41700	37000	19800	23700	28600	16300	18400 L	14900 K
ANTIMONY	6	15	4.0 J	ND	5.3 J	5.8 J	65.1 L	ND	84.5 L	ND
ARSENIC	10	.045	149	39.5	111	16.4	319	25.6	17.4 L	14.9
BARIUM	2,000	2,000*	320	439	164 J	539	2150	560	908 L	698
BERYLLIUM	4	4*	ND	ND	0.66 J	ND	ND	ND	ND	ND
CADMIUM	5	5*	ND	1.2 J	ND	6.5	19.1	1.7 J	1.0 J	6.7
CALCIUM	--	--	ND	682000	ND	ND	ND	799000	230000 L	298000
CHROMIUM	100	100*	647	5960	333	1220	622	8590	185 L	73.9
COBALT	--	11	38.2 J	20.6 J	18.2 J	15.9 J	37.4 J	11.5 J	11.3 J	20.4 J
COPPER	1,300	1,500	ND	ND	ND	ND	1860	ND	ND	ND
IRON	300	26,000	165000	39700	186000	33300	94400	22700	59000 L	24700
LEAD	15	15 (MCL)	126 K	195 K	35.2 K	390 K	9060 K	260 K	171 J	380
MAGNESIUM	--	--	53300	381000	ND	38600	673000	45700	593000 L	280000
MANGANESE	50	880	1600	2160	617	865	567	2590	506 L	467
MERCURY	2	0.57	0.17 J	4.5	0.089 J	4.2	6.0	6.8	ND	0.84
NICKEL	73	730	101	90.4	30.9 J	71.1	338	39.7 J	45.8 L	79.7
POTASSIUM	--	--	ND	64900 J	ND	ND	88900 J	ND	78400 J	74000 J
SELENIUM	50	50*	ND	ND	ND	ND	ND	ND	ND	ND
SILVER	100	180	ND	ND	ND	ND	8.2 J	ND	ND	ND
SODIUM	--	--	ND	171000	ND	ND	346000	ND	288000 L	130000
THALLIUM	2	2*	ND	ND	ND	ND	ND	ND	ND	ND
VANADIUM	3.7	2.6	437	93.7	470	97.3	171	66.2	244 L	65.2
ZINC	5000	11,000	515	495	50.8 J	2150	4680	680	401 L	811
CYANIDE	200	200*	ND	ND	ND	ND	42.5 L	ND	12.2 L	9.0 J

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA or MDE standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

Table 9: Detected Dissolved Inorganics in Groundwater Samples

Detected Analytes (µg/L)	MDE Cleanup Standards	EPA RBC (tap water)	DM-GW-1 BACKGROUND	DM-GW-8	DM-GW-9	DM-GW-10	DM-GW-11	DM-GW-12	DM-GW-13	DM-GW-14
ALUMINUM	50	37,000	ND	ND	ND	ND	ND	ND	ND	ND
ANTIMONY	6	6*	ND	ND	ND	3.1 J	ND	ND	9.3 J	ND
ARSENIC	10	.045	33.2	37.2	ND	16.7	ND	11	3.0 J	ND
BARIUM	2,000	2,000*	50.3 J	81.6 J	73.7 J	343	52.0 J	49.6 J	523	406
CADMIUM	5	5*	ND	ND	ND	ND	ND	ND	ND	ND
CALCIUM	--	--	ND	ND	ND	73900	130000	ND	228000	276000
CHROMIUM	100	100*	ND	ND	3.6 J	15.7	23.2	ND	27.7	7.2 J
COBALT	--	11	25.9 J	12.9 J	ND	4.4 J	1.8 J	31.1 J	4.2 J	ND
IRON	300	26,000	66200	106000	ND	532	ND	57100	1860	72.7 J
LEAD	15	15 (MCL)	2.4 J	3.7 J	ND	ND	ND	ND	ND	ND
MAGNESIUM	--	--	55900	27800	38400	632000	28800	52200	571000	293000
MANGANESE	50	880	1420	569	164	92.8	115	1390	340	223
MERCURY	2	0.57	ND	ND	ND	ND	ND	ND	ND	ND
NICKEL	73	730	47.1	12.3 J	ND	136	2.1 J	52.5	17.0 J	37.0 J
POTASSIUM	--	--	ND	ND	ND	79900 J	ND	ND	69500 J	80200 J
SODIUM	--	--	ND	ND	ND	339000	ND	ND	274000	141000
THALIUM	2	2*	ND	ND	ND	ND	ND	ND	ND	ND
VANADIUM	3.7	2.6	ND	1.6 J	7.3 J	14.2 J	ND	1.1 J	21.1 J	13.9 J
ZINC	5000	11,000	217	ND	ND	ND	ND	ND	ND	ND

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards or MDE Clean Up Standards. Red indicates significant; --: MDE or EPA has not established Cleanup Standards

Table 9 (Cont.): Detected Dissolved Inorganics in Groundwater Samples

Detected Analytes (µg/L)	MDE Cleanup Standards	EPA RBC (tap water)	DM-GW-1 BACKGROUND	DM-GW-2	DM-GW-3	DM-GW-4	DM-GW-5	DM-GW-6	DM-GW-7	DM-GW-15 (dup DM-GW-6)
ALUMINUM	50	37,000	ND	ND	ND	ND	225	ND	ND	ND
ANTIMONY	6	6	ND	ND	ND	ND	ND	4.9 J	ND	4.1 J
ARSENIC	10	.045	33.2	21.3	4.9 J	4.6 J	6.4 J	38.5	21.8	37.1
BARIUM	2,000	2,000*	50.3 J	508	58.4 J	591	131 J	716	73.8 J	711
CADMIUM	5	5*	ND	ND	4.8 J	ND	ND	ND	ND	ND
CALCIUM	--	--	ND	225000	119000	299000	425000	197000	ND	198000
CHROMIUM	100	100*	ND	23.1	ND	4.7 J	180	22.1	ND	22.2
COBALT	--	11	25.9 J	11.9 J	25 J	3.6 J	3.8 J	7.6 J	43.7 J	8.9 J
IRON	300	26,000	66200	30300	93200	772	539	7670	5450	7750
LEAD	15	15 (MCL)	2.4 J	ND	4.3 J	ND	3.6 J	ND	ND	ND
MAGNESIUM	--	--	55900	667000	318000	286000	347000	442000	88400	442000
MANGANESE	50	880	1420	257	2120	247	919	198	1290	199
MERCURY	2	0.57	ND	ND	ND	ND	ND	ND	ND	0.16 J
NICKEL	73	730	47.1	362	38.2 J	78.5	22.3 J	197	35.4 J	197
POTASSIUM	--	--	ND	120000 J	24400 J	37100 J	52900 J	94300 J	ND	93400 J
SODIUM	--	--	ND	517000	120000	ND	152000	455000	ND	455000
THALLIUM	2	2*	ND	ND	11.5 J	ND	ND	ND	ND	ND
VANADIUM	3.7	2.6	ND	5.5 J	ND	9.4 J	7.6 J	29.6 J	ND	29.4 J
ZINC	5000	11,000	217	ND	117	ND	40 J	ND	ND	ND

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards or MDE Clean Up Standards. Red indicates significant; --: MDE or EPA has not established Cleanup Standards

Table 10: Volatile Organic Data for Groundwater

Detected Analytes (µg/L)	MDE Cleanup Standards	EPA RBC (tap water)	GW-1 BACKGROUND	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW-15 (dup GW-6)
ACETONE	550	2.2E+04	ND	27 J	ND	ND	ND	ND	ND	ND
CARBON DISULFIDE	100	1000	ND	ND	ND	ND	ND	ND	ND	ND
CIS-1,2-DICHLOROETHENE	70	70*	3.1 J	ND	9.4 L	ND	ND	ND	ND	ND
BENZENE	5	0.41	ND	260+ L	ND	ND	ND	55 L	9.2 L	55 L
TRICHLOROETHENE	5	2	ND	ND	5.7 L	ND	ND	ND	ND	ND
4-METHYL-2-PENTANONE	630	2000	ND	83 L	ND	ND	ND	ND	ND	ND
TOLUENE	1000	1000*	ND	ND	ND	ND	ND	ND	ND	ND
ETHYLBENZENE	700	1.5	ND	150 L	ND	ND	ND	6.1 L	ND	6.9 L
o-XYLENE	10,000	1200	ND	23 L	ND	ND	ND	5.6 L	ND	5.1 L
M,P-XYLENE	10,000	1200	ND	100 L	ND	ND	ND	ND	ND	ND
ISOPROPYLBENZENE	66	680	ND	21 L	ND	5.6 L	ND	5.2 L	ND	5.2 L
1,4-DICHLOROBENZENE	75	0.43	ND	ND	ND	ND	ND	ND	ND	ND

Table 10 (Cont.): Volatile Organic Data for Groundwater

Detected Analytes (µg/L)	MDE Cleanup Standards	EPA RBC (tap water)	GW-1 BACKGROUND	GW-8	GW-9	GW-10	GW-11	GW-12	GW-13	GW-14
ACETONE	550	2.2E+04	ND	ND	ND	ND	ND	ND	ND	ND
CARBON DISULFIDE	100	1000	ND	ND	ND	ND	3.6 J	ND	ND	ND
CIS-1,2-DICHLOROETHENE	70	70*	3.1 J	12 L	7.7 L	ND	ND	8.6 L	ND	ND
BENZENE	5	0.41	ND	ND	ND	96 L	ND	ND	100 L	ND
TRICHLOROETHENE	5	2	ND	ND	12 L	ND	ND	ND	ND	ND
4-METHYL-2-PENTANONE (MIBK)	630	2000	ND	ND	ND	ND	ND	ND	ND	ND
TOLUENE	1000	1000*	ND	ND	ND	ND	ND	ND	ND	ND
ETHYLBENZENE	700	1.5	ND	ND	ND	ND	ND	ND	ND	ND
o-XYLENE	10,000	1200	ND	ND	ND	ND	ND	ND	2.1 J	ND
M,P-XYLENE	10,000	1200	ND	ND	ND	ND	ND	ND	ND	ND
ISOPROPYLBENZENE	66	680	ND	ND	ND	2.4 J	ND	ND	9.4 L	ND
1,4-DICHLOROBENZENE	75	0.43	ND	2.0 J	ND	ND	ND	2.6 J	ND	ND

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA or MDE standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

Table 10 (Cont.): Volatile Organic Data for Groundwater

Detected Analytes (ug/l)	MDE Cleanup Standards	EPA RBC	GW-1 BACKGROUND	GW-21	GW-22	GW-23
CHLOROETHANE	*3.6*	--	*ND*	*ND*	**22 L**	*ND*
ACETONE	*550*	*2.2E+04*	*ND*	*ND*	**35**	*ND*
CIS-1,2-DICHLOROETHENE	*70*	*70**	**3.1 J**	*ND*	**6.5 L**	**2.2 J**
BENZENE	*5*	*0.41*	*ND*	*ND*	**270+ L**	**11 L**
METHYLCYCLOHEXANE	--	--	*ND*	*ND*	**2.3 J**	*ND*
4-METHYL-2-PENTANONE	*630*	*2000*	*ND*	*ND*	**190 L**	*ND*
TOLUENE	*1000*	*1000**	*ND*	*ND*	**1900+ L**	*ND*
ETHYLBENZENE	*700*	*1.5*	*ND*	*ND*	**480+ L**	*ND*
o-XYLENE	*10,000*	*1200*	*ND*	*ND*	**95 J**	*ND*
m,p-XYLENE	*10,000*	*1200*	*ND*	*ND*	**980+ L**	**2.5 J**
ISOPROPYLBENZENE (cumene)	*66*	*680*	*ND*	*ND*	**12 J**	*ND*

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA or MDE standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

Table 11: Semi-Volatile Organic Data for Groundwater

Detected Analytes (µg/L)	MDE Cleanup Standards	EPA RBC (tap water)	GW-1 BACKGROUND	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW-15 (dup GW-6)
PHENOL	*1.1E+03*	*1.1E+04*	**1.6 J**	**7.9**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
4-METHYLPHENOL (p-cresol)	*18*	*180*	*ND*	**61**	*ND*	*ND*	**3.4 J**	*ND*	*ND*	*ND*
NAPHTHALENE	*0.65*	*0.14*	*ND*	**160+**	*ND*	**6.2**	*ND*	**3.2 J**	*ND*	**5.5**
CAPROLACTAM	--	*1.8E+04*	**3.3 J**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
2-METHYLNAPHTHALENE	*2.4*	*1.5E+02*	*ND*	**6.5**	*ND*	*ND*	*ND*	**1.6 J**	**1.3 J**	**3.1 J**
ACENAPHTHENE	*37*	*2.2E+03*	*ND*	**9.4**	*ND*	**2.7 J**	*ND*	*ND*	**1.2 J**	*ND*
DIBENZOFURAN	*3.7*	*37*	*ND*	**5.6**	*ND*	**1.4 J**	*ND*	*ND*	*ND*	*ND*
DIETHYLPHTHALATE	*2.9E+03*	*2.9E+04*	**1.2 J**	**23**	*ND*	*ND*	*ND*	**2.7 J**	*ND*	*ND*
FLUORENE	*24*	*1.5E+03*	*ND*	**7.2**	*ND*	**1.7 J**	*ND*	*ND*	*ND*	*ND*
N-NITROSODIPHENYLAMINE	*14*	*14*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
PHENANTHRENE	*180*	--	*ND*	**18**	*ND*	**1.7 J**	*ND*	**1.4 J**	**1.2 J**	*ND*
ANTHRACENE	*180*	*1.1E+04*	*ND*	**2.8 J**	*ND*	**1.5 J**	*ND*	**1.3 J**	*ND*	**2.6 J**
CARBAZOLE	*3.3*	--	*ND*	**5.3**	*ND*	**1.6 J**	*ND*	**1.1 J**	*ND*	**1.1 J**
FLUORANTHENE	*150*	*1.5E+03*	*ND*	**9.9 L**	*ND*	**2.1 J**	*ND*	**1.6 J**	*ND*	*ND*
BUTYLBENZYLPHTHALATE	--	*35*	*ND*	**2.0 J**	**6.2 J**	*ND*	*ND*	*ND*	*ND*	*ND*
BIS(2-ETHYLHEXYL)PHTHALATE	*6.0*	*4.8*	*ND*	*ND*	**4.9 J**	*ND*	*ND*	*ND*	*ND*	*ND*
BENZO(K)FLUORANTHENE	*0.3*	*0.29*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA or MDE standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

Table 11 (Cont.): Semi-Volatile Organic Data for Groundwater

Detected Analytes (µg/L)	MDE Cleanup Standards	EPA RBC (tap water)	GW-1 BACKGROUND	GW-8	GW-9	GW-10	GW-11	GW-12	GW-13	GW-14
PHENOL	*1.1E+03*	*1.1E+04*	**1.6 J**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
4-METHYLPHENOL	*18*	*180*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
NAPHTHALENE	*0.65*	*0.14*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	61	*ND*
CAPROLACTAM	--	*1.8E+04*	**3.3 J**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
2-METHYLNAPHTHALENE	*2.4*	*1.5E+02*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**4.9 J**	*ND*
ACENAPHTHENE	*37*	*2.2E+03*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	12	**2.9 J**
DIBENZOFURAN	*3.7*	*37*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	6.8	*ND*
DIETHYLPHTHALATE	*2.9E+03*	*2.9E+04*	**1.2 J**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
FLUORENE	*24*	*1.5E+03*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	9.4	*ND*
N-NITROSODIPHENYLAMINE	*14*	*14*	*ND*	*ND*	*ND*	**1.2 J**	*ND*	*ND*	*ND*	*ND*
PHENANTHRENE	*180*	--	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**2.9 J**	*ND*
ANTHRACENE	*180*	*1.1E+04*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**3.4 J**	*ND*
CARBAZOLE	*3.3*	--	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	9.2	*ND*
FLUORANTHENE	*150*	*1.5E+03*	*ND*	*ND*	**1.1 J**	*ND*	*ND*	**1.1 J**	**1.2 J**	*ND*
BUTYLBENZYLPHTHALATE	--	*35*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**2.6 J**
BIS(2-ETHYLHEXYL)PHTHALATE	*6.0*	*4.8*	*ND*	**3.1 J**	6.5	*ND*	**1.6 J**	*ND*	**3.0 J**	**2.3 J**
BENZO(K)FLUORANTHENE	*0.3*	*0.29*	*ND*	**1.9 J**	*ND*	*ND*	**1.9 J**	*ND*	*ND*	*ND*

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow November 2010 EPA or MDE standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

Table 12: Pesticides and PCBs Detected in Groundwater

Detected Analytes (µg/L)	MDE Cleanup Standards	EPA RBC (tap water)	GW-1 Background	GW-2	GW-3	GW-4	GW-5	GW-6	GW-15 (dup GW-6)
ALPHA-BHC	*0.011*	*0.011*	*ND*	0.33 J	*ND*	0.081 J	*ND*	*ND*	*ND*
BETA-BHC	*0.037*	*0.037*	*ND*	0.33 J	*ND*	0.11 J	0.072 J	*ND*	0.041 J
DELTA-BHC	*0.2*	--	*ND*	*ND*	*ND*	0.16 J	*ND*	*ND*	0.041 J
LINDANE	*0.2*	*0.061*	*ND*	*ND*	*ND*	*ND*	*ND*	0.033 J	0.04 J
HEPTACHLOR	*0.4*	*0.015*	*ND*	*ND*	*ND*	0.11 J	*ND*	0.031 J	*ND*
ALDRIN	*0.0039*	*0.004*	*ND*	*ND*	*ND*	0.17 J	0.13	0.054 J	0.036 J
HEPTACHLOR EPOXIDE	*0.2*	*0.0074*	*ND*	0.31 J	0.025 J	0.21 J	*ND*	*ND*	*ND*
DIELDRIN	*0.0042*	*0.0042*	*ND*	0.16 J	*ND*	0.12 J	*ND*	*ND*	*ND*
4,4,-DDE	*0.2*	*0.2*	*ND*	0.26 J	*ND*	0.10 J	*ND*	*ND*	*ND*
ENDRIN	*2*	*11*	*ND*	0.38 J	*ND*	*ND*	*ND*	*ND*	*ND*
ENDOSULFAN II	*22*	--	*ND*	0.62 J	*ND*	*ND*	*ND*	*ND*	*ND*
4,4-DDD	*0.28*	*0.28*	*ND*	1.0 J	*ND*	0.29 J	*ND*	*ND*	*ND*
ENDOSULFAN SULFATE	*22*	--	*ND*	0.094 J	*ND*	*ND*	*ND*	*ND*	*ND*
4,4-DDT	*0.2*	*0.2*	*ND*	*ND*	*ND*	0.31 J	*ND*	0.084 J	*ND*
METHOXYCHLOR	*40*	*180*	*ND*	0.81 J	*ND*	0.41 J	*ND*	*ND*	*ND*
ENDRIN KETONE	*1.1*	--	*ND*	0.077 J	*ND*	*ND*	*ND*	*ND*	*ND*
ENDRIN ALDEHYDE	*1.1*	--	*ND*	0.55 J	0.11	0.16 J	*ND*	0.27	0.2 J
ALPHA-CHLORDANE	*2*	*0.19*	*ND*	1.4+ J	*ND*	0.15 J	*ND*	*ND*	*ND*
GAMMA-CHLORDANE	*2*	*0.19*	0.037 J	1.4+ J	*ND*	0.19 J	*ND*	*ND*	*ND*
PCB									
AROCHLOR 1242	*0.5*	*0.034*	*ND*	*ND*	*ND*	9.8	*ND*	7.1 J	5.5 J
AROCHLOR 1248	*0.5*	*0.034*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
AROCHLOR 1254	*0.5*	*0.034*	*ND*	*ND*	*ND*	8.7	*ND*	7.2 J	5.0 J
AROCHLOR 1260	*0.5*	*0.034*	*ND*	*ND*	*ND*	3.4	*ND*	1.5 J	0.85 J

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA or MDE standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

Table 12 (Cont.): Pesticides and PCBs Detected in Groundwater

Detected Analytes (µg/L)	MDE Cleanup Standards	EPA RBC (tap water)	GW-1 Background	GW-7	GW-8	GW-9	GW-10	GW-11	GW-12	GW-13	GW-14
ALPHA-BHC	*0.011*	*0.011*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**0.04 J**	*ND*
BETA-BHC	*0.037*	*0.037*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**0.048 J**	*ND*	*ND*
DELTA-BHC	*0.2*	--	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
LINDANE	*0.2*	*0.061*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**0.036 J**	**0.029 J**
HEPTACHLOR	*0.4*	*0.015*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
ALDRIN	*0.0039*	*0.004*	*ND*	*ND*	*ND*	*ND*	**0.053 J**	*ND*	*ND*	**0.035 J**	*ND*
HEPTACHLOR EPOXIDE	*0.2*	*0.0074*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
DIELDRIN	*0.0042*	*0.0042*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
4,4,-DDE	*0.2*	*0.2*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
ENDRIN	*2*	*11*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
ENDOSULFAN II	*22*	--	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
4,4-DDD	*0.28*	*0.28*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
ENDOSULFAN SULFATE	*22*	--	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
4,4-DDT	*0.2*	*0.2*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
METHOXYCHLOR	*40*	*180*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
ENDRIN KETONE	*1.1*	--	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
ENDRIN ALDEHYDE	*1.1*	--	*ND*	*ND*	*ND*	*ND*	**0.07 J**	**0.46**	**0.13 J**	*ND*	*ND*
ALPHA-CHLORDANE	*2*	*0.19*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
GAMMA-CHLORDANE	*2*	*0.19*	**0.037 J**	*ND*	**0.027 J**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
PCB											
AROCHLOR 1242	*0.5*	*0.034*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
AROCHLOR 1248	*0.5*	*0.034*	*ND*	*ND*	*ND*	*ND*	**1.8 J**	*ND*	*ND*	*ND*	*ND*
AROCHLOR 1254	*0.5*	*0.034*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
AROCHLOR 1260	*0.5*	*0.034*	*ND*	*ND*	*ND*	**1.4 J**	**1.8 J**	*ND*	*ND*	*ND*	*ND*

7.2 Soil Sampling Results

For this SI, a total of twelve surface soil samples and twenty-five subsurface soil samples, including a surface and subsurface duplicate, were collected via either hand auger or Geoprobe® technology from sixteen sets of borings. Soil samples were collected in two series; (1) soil boring designated SB, and (2) groundwater boring designated GW. There were thirty samples in the SB series labeled, ***SB-##-Depth*** and an additional eight samples in the GW series labeled, ***GW-##-Depth***. The major difference in the two series is that wells were set in the GW series borings after soil samples were collected. Groundwater sampling locations correspond to the six GW series borings.

As shown in Tables 13 and 14, metals contamination was detected throughout the surface and subsurface soil sampling with arsenic, chromium, lead, nickel and vanadium identified at levels which exceeded MDE and/or EPA benchmark standards. Chromium exceeded benchmarks in all soil samples, using the RBC for hexavalent chromium. Chromium levels were uniformly greater than the 30 ug/kg anticipated level for soils in central Maryland. Arsenic exceeded benchmarks in all but two soil samples, SB-10-00 and SB-15-29. However in many of the samples arsenic levels only slightly exceeded the 4.9 ug/kg anticipated level for soils in central Maryland.

The surface sample collected at SB-16 had elevated levels of hexavalent chromium, the highest level of total chromium and significant levels of arsenic, cobalt, nickel and copper. Subsurface samples collected at SB-04 contained chromium at levels two orders of magnitude greater than those anticipated in the Baltimore region. Hexavalent chromium was detected in all but four surface soil samples at levels generally greater than the EPA RBC and significantly above background. In the subsurface samples, hexavalent chromium was identified in SB-02, SB-05, SB-13, SB-15 and GW-09. The samples at SB-05, SB-02 and SB-15 were greater than the EPA RBC and significantly above background. The sample collected at SB-06 contained hexavalent chromium at 4350 mg/kg three orders of magnitude greater than the industrial RBC.

As shown in Tables 15, VOCs were not identified in significant levels in the GW series soil samples.

Table 16 contains information on VOCs in the SB series of borings. Ethylbenzene was identified in three samples, SB-02-16, SB-03-10 and SB-04-08, at levels significantly above background and greater than EPA RBCs. Benzene was identified in the samples collected from five feet bgs at SB-01 and SB-02 and at 13 feet bgs at SB-15 but only SB-02-05 and SB-15-13 samples were significantly above background. The samples collected from SB-02 at sixteen feet bgs, from SB-03 at ten feet bgs, and from SB-04 at eight feet bgs, contained ethylbenzene at levels greater than regulatory guidelines. Cis-1,2-DCE was identified in samples SB-03-10, SB-06-19, SB-05-08 and SB-15-13 at levels significantly above background. SB-05-08 also contained TCE and PCE at levels significantly above background. PCE in SB-05-08 also exceeded regulatory guidelines. BTEX compounds were identified in SB-02-05, SB-02-16, SB-03-10, SB-06-19, SB-06-29, SB-16-05, SB-04-08, SB-15-13 and SB-04-17 at levels significantly above background.

SVOCs were detected in surface samples collected from all of the SB-series borings. The greatest concentration of SVOCs were found in SB-06-00 and SB-08-00. Benzo(a)anthracene, indino(1,2,3-cd)pyrene, dibenzo(a,h)anthracene and benzo(a)pyrene were identified at levels significantly above background and exceeding regulatory guidelines. A number of SVOCs, including phenanthrene, anthracene, fluoranthene and pyrene, were identified at levels three times background.

SVOCs were also detected in subsurface samples collected from all of the SB-series borings. The sample collected at SB-06 from nineteen feet bgs contained elevated levels of the same list of SVOCs as the surface samples with several additional compounds identified. The deep sample at SB-06 collected 29 feet bgs was relatively clean compared to the other subsurface samples (Table 19).

GW series borings exhibited similar trends to the SB series samples. GW-03, GW-04 and GW-07 contained many of the same semi-volatile constituents as the SB series. GW-12-11, GW-05-01, GW-11-01 and GW-11-04 were relatively clean compared to the other samples collected from the site. The GW-12 sample was collected at the entrance to the site and is believed to be outside of the fill areas which have been identified on the Drumco property.

The SB-01-05 sample designated as the site background was collected from the Pennington Avenue landfill area. The sample collected at GW-12-11 may better represent the true undisturbed background of the area.

Three PCB compounds were detected in samples collected from soil borings at the Drumco site. Aroclor-1242 and Aroclor-1254 were found in elevated levels in SB-01 at five feet bgs and at SB-03 at ten feet bgs. Aroclor-1254 and Aroclor-1260 were identified in levels above RBCs and significantly above background in the surface samples collected from SB-03-00 and SB-06-00. Aroclor 1254 was identified in SB-11-00 and SB-12-00 at levels significantly above background. Aroclor 1260 was identified in samples SB-11-02 and SB-01-00, the background surface soil, at levels below standards.

Aroclor-1260 was identified in the samples collected from the subsurface at SB-02 in levels above the RBC. Aroclor 1260 was also identified in SB-03-28 and SB-15-13 at levels significantly above background but below RBC levels. Aroclor 1242 and 1254 were identified in samples SB-01-05 and SB-03-10 at levels exceeding standards. The same Aroclors were identified in SB-03-10 at levels significantly above background. Aroclor 1242 was identified above RBCs in SB-16-05. The sample collected at SB-02-05 contained Aroclor 1254 at a level that exceeded the RBC.

Several different pesticides were identified in SB series soils, SB-03-00, SB-04-00, SB-05-00 and SB-06-00, at levels significantly above background (Table 21) The only significant levels of pesticides identified in SB series soil samples were from the surface soil sample collected at SB-03. Levels of heptachlor epoxide and dieldrin were identified at levels slightly greater than the RBC for the two chemicals.

Six different pesticides, 4,4-DDE, 4,4'-DDT, endrine ketone, alpha-chlordane, gamma-chlordane and lindane were identified at levels significantly above background in the soil

sample collected at GW-03-00. Aroclor-1242 and Aroclor-1254 were identified in the background sample at levels greater than the RBC. Aroclor-1260 was not detected in the site background sample. Aroclor 1260 was however identified in five of the GW series soils at levels significantly above the sample quantitation limit (SQL) for the site background sample.

Sub surface soil samples collected at SB-02-05 and SB-03-10 contained several pesticides at levels significantly above background.

The sample collected at SB-03-10 contained twelve different pesticides at levels significantly above background. However, none of these detections were greater than the RBC. The SB-03-10 sample contained elevated levels of Aroclor-1242 and Aroclor-1254 significantly above background and greater than their RBC levels. The sample collected at SB-02-05 contained Aroclor -1254 at a level greater than the RBC and Aroclor-1260 at a level both greater than the RBC and significantly above background. Aroclor was identified in samples SB-02-05, SB-03-28, and SB-15-13 at levels significantly above background.

Table 13: Inorganic Data for Surface Soil Samples

Detected Analytes (mg/kg)	MDE Cleanup Standard (non-res)	EPA RBC (ind)	SB-01-00 Background	SB-02-00	SB-03-00	SB-04-00	SB-05-00	SB-06-00	SB-08-00	SB-10-00	SB-11-00
ALUMINUM	1.0E+05	9.9E+05	8200	7880	3220	11400	21600	4480	6300	12200	5810
ANTIMONY	41	410	0.83 J	0.45 J	3.8 J	*ND*	ND	*ND*	*ND*	*ND*	*ND*
ARSENIC	1.9	1.6	4.9	4.7	2.3	5.3	8.9	1.6	5.1	0.73 J	3.1
BARIUM	2.0E+04	1.9E+05	49.2	46.7	83.9	42.6	126	44.7	54.5	69.8	139
BERYLLIUM	200	2000	0.20 J	0.45 J	0.14 J	0.47 J	0.61 J	0.76	*ND*	0.48 J	0.43 J
CADMIUM	51	800	0.58 J	0.78	10.1	0.47 J	6.1	1.3	0.82	*ND*	0.83 J
CALCIUM	--	--	9150	*ND*	*ND*	8560	102000+	241000+	*ND*	1890	126000
CHROMIUM	310	5.6 (Cr+6)	123 K	191	316 K	572 K	6380 K	21400+ K	504	34.0 K	6970 K
COBALT	--	300	3.2 J	8.5	11.9	12.3	89.8	59.3	8.2	3.4 J	5.5 J
COPPER	4100	4.1E+04	53.4 K	ND	126 K	99.4 K	1220 K	113 K	*ND*	19.6 K	280 K
IRON	7.2E+04	7.2E+05	14800	22500	8540	26100	58300	17500	16300	7560	10900
LEAD	1000	800	125	71.9	729	21.4	89.4	49.8	154 L	16.6	123
MAGNESIUM	--	--	2200	*ND*	72200	1460	9190	27800	*ND*	2060	6510
MANGANESE	2000	2.3E+04	139	177	217	75.2	556	173	126	52.2	757
MERCURY	--	34	0.1 J	0.14	0.43	0.26	1.5	0.15	0.26	*ND*	0.15 J
NICKEL	2000	2.0E+04	13.7	144 L	1480	373	3860	222	159	12.9	30.6
POTASSIUM	--	--	650 J	*ND*	225 J	707	2840	*524*	*ND*	1380	726 J
SELENIUM	510	5100	*ND*	*ND*	1.4 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
SILVER	510	5100	0.27 J	0.088 J	0.34 J	0.23 J	0.85 J	0.28 J	0.18 J	*ND*	0.35 J
SODIUM	--	--	*ND*	*ND*	194 B	*ND*	*ND*	1230	*ND*	*ND*	881 J
THALLIUM	7.2	--	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
VANADIUM	100	72	37.4	29.3	14	47.1	65.2	40.6	31.2	41.5	51.2
ZINC	3.1E+04	3.1E+05	165	137	177	119	1280	131	175	29.3	382
CYANIDE	2000	2.0E+04	0.5 J	5.9 K	0.68 J	0.64 J	7.2	1.1 J	0.32 J	*ND*	0.62 J

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards or MDE Clean Up Standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

Table 13: (Cont.) Inorganic Data for Surface Soil Samples

Detected Analytes (mg/kg)	MDE Cleanup Standard (non-res)	EPA RBC (ind)	SB-01-00 Background	SB-11-02	SB-12-00	SB-16-00	GW-03-00	GW-05-01	GW-11-01
ALUMINUM	1.0E+05	9.9E+05	8200	1960	7270	15600	8290	4650	5360
ANTIMONY	41	410	0.83 J	*ND*	0.65 J	*ND*	3.5 J	*ND*	*ND*
ARSENIC	1.9	1.6	4.9	3.0	3.3	12.5	10.1	4.3	4.6
BARIUM	2.0E+04	1.9E+05	49.2	135	48.1	99.8	742	111	118
BERYLLIUM	200	2000	0.20 J	0.091 J	0.26 J	0.47 J	0.43 J	0.21 J	0.1 J
CADMIUM	51	800	0.58 J	0.29 J	0.41 J	11.5	8.5	0.82 J	0.73 J
CALCIUM	--	--	9150	178000+	5990	156000+J	*ND*	170000+ J	150000 J
CHROMIUM	310	5.6 (Cr+6)	123 K	1780 K	51.8 K	12200+	106	8950	6330
COBALT	--	300	3.2 J	1.2 J	5.1 J	149	10.5	4.6 J	4.4 J
COPPER	4100	4.1E+04	53.4 K	301 K	36.1 K	1600 L	370 L	345 L	*ND*
IRON	7.2E+04	7.2E+05	14800	2360	13000	70800	33100	6440	8490
LEAD	1000	800	125	40.6	77.2	85.9	1130	113	101
MAGNESIUM	--	--	2200	4960	1070	*ND*	*ND*	*ND*	*ND*
MANGANESE	2000	2.3E+04	139	509	122	776	574	566	677
MERCURY	--	34	0.1 J	0.12 J	0.099 J	1.5	2.0	0.26	0.31
NICKEL	2000	2.0E+04	13.7	6.3 J	17.6	6600 L	64.6 L	46.2 L	23.3 L
POTASSIUM	--	--	650 J	261 J	666 J	1810	*ND*	*ND*	*ND*
SELENIUM	510	5100	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
SILVER	510	5100	0.27 J	*ND*	*ND*	1.0 J	0.7 J	0.35 J	0.22 J
SODIUM	--	--	*ND*	1500	*ND*	*ND*	*ND*	*ND*	*ND*
THALLIUM	7.2	--	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
VANADIUM	100	72	37.4	17.6	27.1	73.7	39.9	49.6	42.9
ZINC	3.1E+04	3.1E+05	165	132	106	1890+	1570+	357	294
CYANIDE	2000	2.0E+04	0.5 J	*ND*	*ND*	38.7+K	15.9+K	29.7+K	22.0 K

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards or MDE Clean Up Standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

Table 13 (Cont.): Inorganic Data for Subsurface Soil Samples

Detected Analytes (mg/kg)	MDE Cleanup Standard (non-res)	EPA RBC (ind)	SB-01-05 Background	SB-02-05	GW-07-06	GW-09-09	GW-11-04	SB-04-08	SB-05-08	SB-16-05
ALUMINUM	1.0E+05	9.9E+05	8330	20000	5410	1800	15100	16900	10300	6250
ANTIMONY	41	410	4.4 J	7 J	1.0 J	*ND*	0.58 J	5.1 J	ND	4.1 J
ARSENIC	1.9	1.6	10.3	17.4	24.1	4.2	15.5	10	4.8	9.5
BARIUM	2.0E+04	1.9E+05	453	527	188	137	59.2	304	198	981
BERYLLIUM	200	2000	0.18 J	0.27 J	0.07 J	*ND*	0.45 J	0.22 J	0.18 J	0.14 J
CADMIUM	51	800	10.1	24.1	4.5	0.099 J	0.18 J	4.8	3.0	4.2
CALCIUM	--	--	32700	29100	36800 J	255000+	*ND*	78900 J	33400 J	19600
CHROMIUM	310	5.6 (Cr+6)	683 K	1720 K	400	680	42.4	3150	899	164 K
COBALT	--	300	10.3	27.2	10.7	0.84 J	6.8 J	48.7	15.5	7.9
COPPER	4100	4.1E+04	345 K	906 K	*ND*	*ND*	*ND*	391 L	147 L	667 K
IRON	7.2E+04	7.2E+05	34500	170000+	26100	2390	22000	26700	22800	18100
LEAD	1000	800	850	1320	516	28.8 L	33.2	578	367	234
MAGNESIUM	--	--	4790	5330	45500	*ND*	*ND*	13600	7960	5060
MANGANESE	2000	2.3E+04	326	784	265	638	139	266	292	271
MERCURY	--	34	0.38	0.54	0.37	8.3	0.12 J	0.83	0.9	0.17
NICKEL	2000	2.0E+04	69.7	189	68.5 L	2.5 J	13.2 L	1840 L	515 L	112
POTASSIUM	--	--	866	504 J	*ND*	*ND*	*ND*	*ND*	*ND*	541
SELENIUM	510	5100	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
SILVER	510	5100	0.84 J	1.1 J	0.35 J	*ND*	*ND*	0.43 J	0.76 J	0.21 J
SODIUM	--	--	*ND*	618 J	*ND*	*ND*	*ND*	*ND*	*ND*	1290
THALLIUM	7.2	--	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
VANADIUM	100	72	32.3	37.2	51.1	4.6 J	28.8	40.0	64.0	32.6
ZINC	3.1E+04	3.1E+05	1720+	11600+	1170	84.7	68.0	1410+	410	*ND*
CYANIDE	2000	2.0E+04	0.78 J	2.1 J	5.4 K	*ND*	2.3 J	8.3 K	7.3 K	2.1 J

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards or MDE Clean Up Standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

Table 13 (Cont.): Inorganic Data for Subsurface Deep Soil Samples

Detected Analytes (mg/kg)	MDE Cleanup Standard (non-res)	EPA RBC (ind)	SB-01-05 Background	SB-02-16	SB-03-10	SB-07-08	SB-13-12	SB-15-13	GW-04-11	GW-12-11
ALUMINUM	1.0E+05	9.9E+05	8330	7420	5130	5280	7300	10400	9510	7740
ANTIMONY	41	410	4.4 J	3.2 J	3.1 J	0.38 J	1.1 J	1.1 J	1.3 J	0.64 J
ARSENIC	1.9	1.6	10.3	6.3	14.8	2.1	13.3	6.1	7.6	4.3
BARIUM	2.0E+04	1.9E+05	453	634	297	37.7	62.5	313	91.4	22.9
BERYLLIUM	200	2000	0.18 J	0.094 J	0.36 J	0.28 J	*ND*	0.53 J	*ND*	0.3 J
CADMIUM	51	800	10.1	2.4	3.0	0.031 J	0.24 J	1.3	0.76	0.28 J
CALCIUM	--	--	32700	21300	37900	24900	*ND*	43100	23400	*ND*
CHROMIUM	310	5.6 (Cr+6)	683 K	209 K	86.1 K	14.1 K	48.9	222 K	40.2	25.4
COBALT	--	300	10.3	9.1	7.2	2.6 J	3.0 J	5.8 J	6.1 J	3.1 J
COPPER	4100	4.1E+04	345 K	289 K	127 K	14.7 K	1230	148 K	*ND*	*ND*
IRON	7.2E+04	7.2E+05	34500	14000	25200	6920	6210	16200	17100	22600
LEAD	1000	800	850	346	1110	38.7	128 L	1030	153 L	6.9
MAGNESIUM	--	--	4790	9850	2780	2300	*ND*	6150	5130	*ND*
MANGANESE	2000	2.3E+04	326	229	247	140	142	220	264	67.8
MERCURY	--	34	0.38	0.12	1.2	ND	2.5	1.0	0.39	*ND*
NICKEL	2000	2.0E+04	69.7	91.4	43.8	5.1	5.6 J	68.1	17.6	5.5 L
POTASSIUM	--	--	866	512 J	514 J	661	*ND*	937	*ND*	*ND*
SELENIUM	510	5100	*ND*	*ND*	*ND*	*ND*	1.4 J	*ND*	*ND*	*ND*
SILVER	510	5100	0.84 J	0.19 J	0.36 J	*ND*	0.25 J	0.22 J	*ND*	*ND*
SODIUM	--	--	*ND*	898	*ND*	*ND*	*ND*	520 J	*ND*	*ND*
THALLIUM	7.2	--	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
VANADIUM	100	72	32.3	46.6	75.5	16.4	25.5	29.5	29.2	50.3
ZINC	3.1E+04	3.1E+05	1720+	*ND*	972	29.0	88.7	362	138	13.7
CYANIDE	2000	2.0E+04	0.78 J	1.6 J	1.5 J	*ND*	*ND*	0.56 J	*ND*	0.27 J

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards or MDE Clean Up Standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

Table 13 (Cont.): Inorganic Data for Subsurface Deep Soil Samples

Detected Analytes (mg/kg)	MDE Cleanup Standard (non-res)	EPA RBC (ind)	SB-01-05 Background	SB-03-28	SB-04-17	SB-05-15	SB-06-19	SB-06-29	SB-10-23	SB-14-50	SB-15-29
ALUMINUM	1.0E+05	9.9E+05	8330	7110	19100	5400	10000	13400	7580	2740	4270
ANTIMONY	41	410	4.4 J	21.4 L	*ND*	*ND*	2.2 J	1.3 J	6.9 J	0.4 J	0.41 J
ARSENIC	1.9	1.6	10.3	8.2	12	5.7	7.7	28.6	19.9	2.4	1.5
BARIUM	2.0E+04	1.9E+05	453	142	153	188	855	147	281	25.5 J	23.3
BERYLLIUM	200	2000	0.18 J	0.14 J	0.9	0.16 J	0.55 J	0.65 J	*ND*	0.075 J	0.17 J
CADMIUM	51	800	10.1	0.97	6.2	2.2	0.42 J	2.4	10.7	*ND*	0.066 J
CALCIUM	--	--	32700	25500	77400 J	31900 J	9890	3860	*ND*	*ND*	*ND*
CHROMIUM	310	5.6 (Cr+6)	683 K	229 K	2550	516	99.1 K	462 K	173	26.9	17.7
COBALT	--	300	10.3	10.9	43.0	21.6	9.4	19.5	11.8	0.85 J	3.2 J
COPPER	4100	4.1E+04	345 K	113 K	238 L	*ND*	195 K	145 K	427	*ND*	*ND*
IRON	7.2E+04	7.2E+05	34500	51300	23000	19100	28200	32500	155000+	5630	11000
LEAD	1000	800	850	565	436	816	182	212	695 L	15.0	7.3
MAGNESIUM	--	--	4790	24800	8080	33700	4590	8720	*ND*	*ND*	*ND*
MANGANESE	2000	2.3E+04	326	318	641	317	261	354	602	81.7	68.0
MERCURY	--	34	0.38	0.25	2.1	0.63	0.37	0.62	0.23	0.075 J	*ND*
NICKEL	2000	2.0E+04	69.7	115	1830 L	360 L	25.6	41.6	85.9	1.9 J	3.3 J
POTASSIUM	--	--	866	582 J	*ND*	*ND*	1080	1870	*ND*	*ND*	*ND*
SELENIUM	510	5100	*ND*	*ND*	*ND*	*ND*	*ND*	1.4 J	*ND*	*ND*	*ND*
SILVER	510	5100	0.84 J	0.29 J	0.24 J	0.23 J	0.088 J	0.4 J	0.39 J	*ND*	*ND*
SODIUM	--	--	*ND*	425 J	*ND*	*ND*	*ND*	1180	*ND*	*ND*	*ND*
THALLIUM	7.2	--	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
VANADIUM	100	72	32.3	172	51.8	36.5	34.3	57.3	34.0	10.4	27.7
ZINC	3.1E+04	3.1E+05	1720+	577	1770+	395	2120+	422	1470+	13.9	15.3
CYANIDE	2000	2.0E+04	0.78 J	0.52 J	8.4 K	3.2 K	0.51 J	1.2 J	*ND*	2.3 J	0.81 J

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards or MDE Clean Up Standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

Table 14: Hexavalent Chromium Data for Soil Samples

CHROMIUM+6	(mg/kg) (SQL=0.5)	MDE Cleanup Standard (non-res)	310	EPA-RBC (ind)	5.6
SURFACE SOIL		**SUBSURFACE SOIL**		**DEEP SOIL**	
SB-01-00 Background	*ND*	SB-01-05	*ND*		
SB-02-00	8.3	SB-02-05	*ND*	SB-02-16	14.3
SB-03-00	11.2	SB-03-10	*ND*	SB-03-28	*ND*
SB-04-00	19.8	SB-04-08	*ND*	SB-04-17	*ND*
SB-05-00	*ND*	SB-05-08	48.5	SB-05-15	*ND*
SB-06-00	4350	SB-06-19	*ND*	SB-06-29	*ND*
		SB-07-08	*ND*		
SB-08-00-	1.2				
SB-10-00	*ND*			SB-10-23	*ND*
SB-11-00	33.0				
SB-11-02	11.4				
SB-12-00	1.0				
				SB-13-12	3.1
				SB-14-50	*ND*
		SB-15-13	47.1	SB-15-29	0.9
SB-16-00-	39.7 J	SB-16-05	*ND*		
GW-03-00	*ND*				
				GW-04-11	*ND*
GW-05-01	68.0				
		GW-07-06	*ND*		
		GW-09-09	1.9		
GW-11-01	53.9	GW-11-04	*ND*		
				GW-12-11	*ND*

TABLE 15: GW SERIES SOIL SAMPLES – VOLATILE ORGANIC COMPOUNDS

Detected Analytes (ug/Kg)	MDE Cleanup Standards (non-res)	EPA RBC (ind)	GW-04-11	GW-07-06	GW-09-09	GW-12-11
CHLOROETHANE	*9.9E+05*	*6.1E+07*	*ND*	*ND*	*ND*	*ND*
ACETONE	*9.2E+07*	*6.3E+08*	*ND*	*ND*	*ND*	*ND*
CIS-1,2-DICHLOROETHENE	*1.0E+06*	*2.0E+06*	*ND*	*ND*	*ND*	*ND*
BENZENE	*5.2E+04*	*5.4E+03*	*ND*	*ND*	*ND*	*ND*
TRICHLOROETHENE	*7.2E+03*	*1.4E+04*	*ND*	*ND*	*ND*	*ND*
METHYLCYCLOHEXANE	--	--	*ND*	*ND*	*ND*	*ND*
4-METHYL-2-PENTANONE	--	*5.3E+07*	*ND*	*ND*	*ND*	*ND*
TOLUENE	*8.2E+06*	*4.5E+07*	*ND*	*ND*	*ND*	*ND*
ETHYLBENZENE	*1.0E+07*	*2.7E+04*	*ND*	*ND*	*ND*	*ND*
o-XYLENE	*2.0E+07*	*1.9E+07*	*ND*	*ND*	*ND*	*ND*
m,p-XYLENE	*2.0E+07*	*1.9E+07*	*ND*	*ND*	*ND*	*ND*
ISOPROPYLBENZENE (cumene)	*1.0E+07*	*1.1E+07*	*ND*	*ND*	*ND*	*ND*

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards or MDE Clean Up Standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

TABLE 16: VOLATILE ORGANIC COMPOUNDS IN SOIL SAMPLES

Detected Analytes (ug/Kg)	MDE Cleanup Standards (non-res)	EPA RBC (ind)	SB-01-05 Background	SB-02-05	SB-02-16	SB-03-10	SB-06-19
VINYL CHLORIDE	*4.0E+03*	*1.7*	*ND*	*ND*	*ND*	*ND*	**9.6 J**
ACETONE	*9.2E+07*	*6.3E+08*	**38 J**	*ND*	*ND*	*ND*	**50 J**
CIS-1,2-DICHLOROETHENE	*1.0E+06*	*2.0E+06*	*ND*	*ND*	*ND*	**6500**	**11 J**
CYCLOHEXANE	--	*2.9E+07*	*ND*	*ND*	*ND*	*ND*	**4.0 J**
BENZENE	*5.2E+04*	*5.4E+03*	**24 K**	**990 L**	*ND*	*ND*	**3.8 J**
TRICHLOROETHENE	*7.2E+03*	*1.4E+04*	*ND*	*ND*	*ND*	*ND*	**10 J**
METHYLCYCLOHEXANE	--	--	*ND*	**680 L**	*ND*	**4500 J**	*ND*
4-METHYL-2-PENTANONE	--	*5.3E+07*	*ND*	*ND*	*ND*	*ND*	*ND*
TOLUENE	*8.2E+06*	*4.5E+07*	*ND*	**200 J**	*ND*	**19000**	**14 J**
ETHYLBENZENE	*1.0E+07*	*2.7E+04*	**4.6 J**	**13000 L**	**690000 L**	**57000**	**34 J**
o-XYLENE	*2.0E+07*	*1.9E+07*	**2.4 J**	**910 L**	**250000 L**	**39000**	**19 J**
m,p-XYLENE	*2.0E+07*	*1.7E+07*	**9.6**	**1900 L**	**1100000 L**	**150000**	**27 J**
ISOPROPYLBENZENE	*1.0E+07*	*1.1E+07*	**2.6 J**	**4500 L**	*ND*	**3100 J**	**3.6 J**

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards or MDE Clean Up Standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

TABLE 16 (Cont.): VOLATILE ORGANIC COMPOUNDS IN SOIL SAMPLES

Detected Analytes (ug/Kg)	MDE Cleanup Standards (non-res)	EPA RBC (ind)	SB-01-05 Background	SB-06-29	SB-07-08	SB-16-05	SB-04-08	SB-05-08	SB-15-13
VINYL CHLORIDE	*4.0E+03*	*1.7*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
ACETONE	*9.2E+07*	*6.3E+08*	**38 J**	**150 J**	**28 J**	*ND*	*ND*	*ND*	*ND*
CARBON DISULFIDE	*1.0E+07*	*3.7E+06*	*ND*	**16 J**	*ND*	*ND*	*ND*	*ND*	*ND*
CIS-1,2-DICHLOROETHENE	*1.0E+07*	*2.0E+06*	*ND*	*ND*	*ND*	*ND*	*ND*	**550 L**	**1500 J**
CYCLOHEXANE	--	*2.9E+07*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
BENZENE	*5.2E+04*	*5.4E+03*	**24 K**	*ND*	*ND*	*ND*	*ND*	*ND*	**2400 J**
1,2-DICHLOROETHANE	*3.1E+04*	*2.2E+03*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**1200 J**
TRICHLOROETHENE	*7.2E+03*	*1.4E+04*	*ND*	*ND*	*ND*	*ND*	*ND*	**360 L**	*ND*
TETRACHLOROETHENE	5.3E+03	2.6E+03	*ND*	*ND*	*ND*	*ND*	*ND*	**4200 L**	*ND*
METHYLCYCLOHEXANE	--	--	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
4-METHYL-2-PENTANONE	--	*5.3E+07*	*ND*	*ND*	*ND*	**4500 J**	*ND*	*ND*	**6000 J**
TOLUENE	*8.2E+06*	*4.5E+07*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**21000 J**
ETHYLBENZENE	*1.0E+07*	*2.7E+04*	**4.6 J**	**95 J**	**5.7 L**	**42000 L**	**190000 L**	*ND*	**25000 J**
o-XYLENE	*2.0E+07*	*1.9E+07*	**2.4 J**	**76 J**	**1.9 J**	**3300 L**	**68000 L**	*ND*	**17000 J**
m,p-XYLENE	*2.0E+07*	*1.7E+07*	**9.6**	**77 J**	**7.6 L**	**9400 L**	**280000 L**	*ND*	**52000 J**
ISOPROPYLBENZENE	*1.0E+07*	*1.1E+07*	**2.6 J**	*ND*	**3.3 J**	*ND*	*ND*	*ND*	**4300 J**

TABLE 16 (Cont.): VOLATILE ORGANIC COMPOUNDS IN SOIL SAMPLES

Detected Analytes (ug/kg)	MDE Cleanup Standard (non-res)	EPA RBC (ind)	SB-01-05 Background	SB-04-17	SB-05-15	SB-10-23	SB-13-12	SB-14-50	SB-15-29
ACETONE	*9.2E+07*	*6.3E+08*	**38 J**	*ND*	*ND*	*ND*	*R/ND*	*ND*	**42 J**
CIS-1,2-DICHLOROETHENE	*1.0E+07*	*2.0E+06*	*ND*	*ND*	*ND*	*ND*	*R/ND*	*ND*	*R/ND*
TRICHLOROETHENE	*7.2E+03*	*1.4E+04*	*ND*	*ND*	*ND*	*ND*	*R/ND*	*ND*	*R/ND*
TETRACHLOROETHENE	5.3E+03	2.6E+03	*ND*	*ND*	*ND*	*ND*	*R/ND*	*ND*	*R/ND*
ETHYLBENZENE	*1.0E+07*	*2.7E+04*	**4.6 J**	**1500 L**	*ND*	*ND*	*R/ND*	*ND*	**1.6 J**
O-XYLENE	*2.0E+07*	*1.9E+07*	**2.4 J**	*ND*	*ND*	*ND*	*R/ND*	*ND*	*R/ND*
M,P-XYLENE	*2.0E+07*	*1.7E+07*	**9.6**	**890 L**	*ND*	*ND*	*R/ND*	*ND*	**2.7 J**

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards or MDE Clean Up Standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

TABLE 17: SEMIVOLATILE ORGANIC COMPOUNDS IN SURFACE SOIL SAMPLES

Detected Analytes (ug/kg)	MDE Cleanup Standards	EPA RBC (non-res)	SB-01-00 Background	SB-02-00	SB-03-00	SB-04-00	SB-05-00	SB-06-00
BENZALDEHYDE	--	*1.0E+08*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
PHENOL	*3.1E+07*	*1.8E+08*	*ND*	*ND*	**83 J**	*ND*	*ND*	*ND*
ISOPHORONE	*3.0E+06*	*1.8E+05*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
NAPHTHALENE	*2.E+06*	*1.8+04*	**58 J**	*ND*	**39 J**	*ND*	*ND*	**100 J**
2,4,5-TRICHLOROPHENOL	*1.0E+07*	*6.2E+07*	*ND*	*ND*	**75 J**	*ND*	*ND*	*ND*
DIMETHYLPHTHALATE	--	--	*ND*	*ND*	*ND*	*ND*	**120 J**	*ND*
ACENAPHTHENE	*6.1E+06*	*3.3E+07*	*ND*	*ND*	*ND*	*ND*	*ND*	**100 J**
DIBENZOFURAN	*1.0E+05*	*1.0E+06*	*ND*	*ND*	*ND*	*ND*	*ND*	**50 J**
FLUORENE	*4.1 E+06*	*2.2E+07*	*ND*	*ND*	*ND*	*ND*	*ND*	**63 J**
HEXACHLOROBENZENE	*1.8E+03*	*1.1E+03*	*ND*	*ND*	**84 J**	*ND*	*ND*	*ND*
PHENANTHRENE	*3.1E+07*	--	**200 J**	**80 J**	**210**	**46 J**	**59 J**	**1400**
ANTHRACENE	*3.1E+07*	*1.7E+08*	*ND*	*ND*	**47 J**	*ND*	*ND*	**310**
CARBAZOLE	*1.4E+05*	--	*ND*	*ND*	*ND*	*ND*	*ND*	**270 L**
DI-N-BUTYLPHTHALATE	*1.0E+07*	*6.2E+07*	*ND*	*ND*	**220**	*ND*	*ND*	*ND*
FLUORANTHENE	*4.1E+06*	*2.2E+07*	**240**	**110 J**	**360**	**57 J**	**95 J**	**1600**
PYRENE	*3.1E+06*	*1.7E+07*	**270**	**170 J**	**320**	**72 J**	**88 J**	**1300**
BUTYLBENZYLPHTHALATE	--	*9.1E+05*	**92 J**	*ND*	**100 J**	*ND*	*ND*	**87 J**
BENZO(A)ANTHRACENE	*3.9E+03*	*2.1E+03*	**150 J**	**80 J**	**160 J**	**39 J**	**56 J**	**710**
CHRYSENE	*3.9E+05*	*2.1E+05*	**160 J**	**87 J**	**220**	**46 J**	**59 J**	**860**
BIS(2-ETHYLHEXYL)PHTHALATE	*2.0E+05*	*1.2E+05*	**310 J**	*ND*	**2900**	**180 J**	**290**	**1600 L**
DI-N-OCTYLPHTHALATE	--	--	*ND*	*ND*	*ND*	*ND*	*ND*	**130 J**
BENZO(B)FLUORANTHENE	*3.9E+03*	*2.1E+03*	**180 J**	**110 J**	**190 J**	**47 J**	**57 J**	**470**
BENZO(K)FLUORANTHENE	*3.9E+04*	*2.1E+04*	**84 J**	**47 J**	**86 J**	*ND*	*ND*	**490**
BENZO(A)PYRENE	*3.9E+02*	*210*	**110 J**	**68 J**	**120 J**	*ND*	**48 J**	**480**
INDENO(1,2,3-CD)PYRENE	*3.9E+03*	*2100*	**110 J**	**69 J**	**92 J**	*ND*	*ND*	**230**
DIBENZO(A,H)ANTHRACENE	*3.9E+03*	*210*	*ND*	*ND*	*ND*	*ND*	*ND*	**89 J**
BENZO(G,H,I)PERYLENE	*3.1E+06*	--	**130 J**	**80 J**	**99 J**	*ND*	*ND*	**210**

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards or MDE Clean Up Standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

TABLE 17 (Cont): SVOC IN SURFACE SOIL SAMPLES

Detected Analytes (ug/kg)	MDE Cleanup Standards	EPA RBC (non-res)	SB-01-00 Background	SB-08-00	SB-10-00	SB-11-00	SB-12-00
BENZALDEHYDE	--	*1.0E+08*	*ND*	**140 J**	*ND*	*ND*	*ND*
PHENOL	*3.1E+07*	*1.8E+08*	*ND*	*ND*	*ND*	*ND*	*ND*
ISOPHORONE	*3.0E+06*	*1800*	*ND*	*ND*	*ND*	*ND*	*ND*
NAPHTHALENE	*2.0E+06*	*18000*	**58 J**	**480**	*ND*	*ND*	*ND*
2-METHYLNAPHTHALENE	*4.1E+05*	*4.1E+06*	*ND*	**390**	*ND*	*ND*	*ND*
1,1'-BIPHENYL	--	*2.1E+05*	*ND*	**79 J**	*ND*	*ND*	*ND*
2,4,5-TRICHLOROPHENOL	*1.0E+07*	*6.2E+07*	*ND*	*ND*	*ND*	*ND*	*ND*
DIMETHYLPHTHALATE	--	--	*ND*	**130 J**	*ND*	*ND*	*ND*
ACENAPHTHENE	*6.1E+06*	*3.3E+07*	*ND*	**930**	*ND*	*ND*	*ND*
2,4-DINITROPHENOL	*2.0E+05*	*1.2E+06*	*ND*	**400 R**	*ND*	*ND*	*ND*
DIBENZOFURAN	*1.0E+05*	*1.0E+06*	*ND*	**990**	*ND*	*ND*	*ND*
FLUORENE	*4.1E+06*	*2.2E+07*	*ND*	**1300**	*ND*	*ND*	*ND*
4,6-DINITRO-2-METHYLPHENOL	--	--	*ND*	**400 R**	*ND*	*ND*	*ND*
PENTACHLOROPHENOL	*2.4E+04*	*2.7E+03*	*ND*	**400 R**	*ND*	*ND*	*ND*
HEXACHLOROBENZENE	*1.8E+03*	*1.1E+03*	*ND*	*ND*	*ND*	*ND*	*ND*
PHENANTHRENE	*3.1E+07*	--	**200 J**	**13000**	*ND*	*ND*	**73 J**
ANTHRACENE	*3.1E+07*	*1.7E+08*	*ND*	**2600**	*ND*	*ND*	*ND*
CARBAZOLE	*1.4E+05*	--	*ND*	**2100**	*ND*	*ND*	*ND*
DI-N-BUTYLPHTHALATE	*1.0E+07*	*6.2E+07*	*ND*	*ND*	*ND*	*ND*	*ND*
FLUORANTHENE	*4.1E+06*	*2.2E+07*	**240**	**13000**	*ND*	*ND*	**130 J**
PYRENE	*3.1E+06*	*1.7E+07*	**270**	**9800**	*ND*	*ND*	**120 J**
BUTYLBENZYLPHTHALATE	--	*9.1E+05*	**92 J**	*ND*	*ND*	*ND*	**560**
BENZO(A)ANTHRACENE	*3.9E+03*	*2.1E+03*	**150 J**	**5800**	*ND*	*ND*	**83 J**
CHRYSENE	*3.9E+05*	*2.1E+05*	**160 J**	**5300**	*ND*	*ND*	**79 J**
BIS(2-ETHYLHEXYL)PHTHALATE	*2.0E+05*	*1.2E+05*	**310 J**	**120 J**	**340 J**	**240 J**	**2400**
DI-N-OCTYLPHTHALATE	--	--	*ND*	*ND*	*ND*	*ND*	*ND*
BENZO(B)FLUORANTHENE	*3.9E+03*	*2.1E+03*	**180 J**	**6300**	*ND*	*ND*	**67 J**
BENZO(K)FLUORANTHENE	*3.9E+04*	*2.1E+04*	**84 J**	**2300**	*ND*	*ND*	**59 J**
BENZO(A)PYRENE	*3.9E+02*	*210*	**110 J**	**3800**	*ND*	*ND*	**71 J**
INDENO(1,2,3-CD)PYRENE	*3.9E+03*	*210*	**110 J**	**2400**	*ND*	*ND*	*ND*
DIBENZO(A,H)ANTHRACENE	*3.9E+02*	*210*	*ND*	**1000**	*ND*	*ND*	*ND*
BENZO(G,H,I)PERYLENE	*3.1E+06*	--	**130 J**	**2000**	*ND*	*ND*	*ND*

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards or MDE Clean Up Standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

TABLE 18: SVOCS IN SUBSURFACE SOIL SAMPLES

Detected Analytes (ug/kg)	MDE Cleanup Standards	EPA RBC (non-res)	SB-01-05 Background	SB-02-05	SB-03-10	SB-07-08	SB-11-02	SB-16-05
PHENOL	*3.1E+07*	*1.8E+08*	*ND*	*ND*	**810**	*ND*	*ND*	*ND*
2-METHYLPHENOL	*5.1E+06*	--	*ND*	*ND*	**3100**	*ND*	*ND*	*ND*
4-METHYLPHENOL	*5.1E+05*	--	*ND*	*ND*	**3200**	*ND*	*ND*	*ND*
2,4-DIMETHYLPHENOL	*2.0E+06*	*1.2E+07*	*ND*	*ND*	**18000+**	*ND*	*ND*	*ND*
ISOPHORONE	*3.0E+06*	*1.8E+06*	*ND*	**640**	*ND*	*ND*	*ND*	*ND*
NAPHTHALENE	*2.0E+06*	*1.8E+04*	**4600+**	**4200**	**13000+**	**500**	**160 J**	**4800+**
CAPROLACTAM	--	*3.1E+08*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
2-METHYLNAPHTHALENE	*4.1E+05*	*4.1E+06*	**1200**	**2300**	**4600 J**	**140 J**	*ND*	**5400+**
1,1'-BIPHENYL	--	*5.1E+07*	**110 J**	**340 J**	**5000**	*ND*	*ND*	**490**
DIMETHYLPHTHALATE	--	--	**200 J**	*ND*	*ND*	*ND*	*ND*	*ND*
ACENAPHTHYLENE	*6.1E+06*	--	**200 J**	**1100**	**220 J**	*ND*	*ND*	**340**
ACENAPHTHENE	*6.1E+06*	*3.3E+07*	**290**	**940**	**1400**	*ND*	*ND*	**950**
DIBENZOFURAN	*1.0E+05*	*1.0E+06*	**180 J**	**500**	**1400**	**170 J**	*ND*	**670**
DIETHYLPHTHALATE	*8.2E+07*	*4.9E+08*	**82 J**	*ND*	*ND*	*ND*	*ND*	**2100**
FLUORENE	*4.1E+06*	*2.2E+07*	**380**	**1500**	**2200**	**260**	*ND*	**1100**
PHENANTHRENE	*3.1E+07*	--	**1700**	**6100**	**9000+**	**970**	*ND*	**5800+**
ANTHRACENE	*3.1E+07*	*1.7E+08*	**490**	**2300**	**3300 J**	**120 J**	*ND*	**1200**
CARBAZOLE	*1.4E+05*	--	**180 J**	**670**	**1900 J**	**61 J**	*ND*	**410**
DI-N-BUTYLPHTHALATE	*1.0E+07*	*6.2E+07*	**220**	**410 J**	**2300 J**	*ND*	*ND*	**140 J**
FLUORANTHENE	*4.1E+06*	*2.2E+07*	**1900**	**6400**	**5600 J**	**1200**	*ND*	**2900**
PYRENE	*3.1E+06*	*1.7E+07*	**2500+**	**11000+**	**6500+**	**1200**	*ND*	**4900+**
BUTYLBENZYLPHTHALATE	--	*9.1E+05*	**3100 J**	**3200 J**	**32000+**	**510**	*ND*	**2300 J**
BENZO(A)ANTHRACENE	*3.9E+03*	*2.1E+03*	**1500 J**	**5100 J**	**3000 J**	**530**	*ND*	**2100 J**
CHRYSENE	*3.9E+05*	*2.1E+05*	**1300 J**	**5800 J**	**3200 J**	**410**	*ND*	**2800 J**
BIS(2-ETHYLHEXYL)PHTHALATE	*2.0E+05*	*1.2E+05*	**30000+**	**36000+**	**25000+**	**57000+J**	**550**	**2000 J**
DI-N-OCTYLPHTHALATE	--	--	**2600 J**	**3300 J**	**96 J**	*ND*	*ND*	**140 J**
BENZO(B)FLUORANTHENE	*3.9E+03*	*2.1E+03*	**1100 J**	**3900 J**	**1900 J**	**610 L**	*ND*	**1300 J**
BENZO(K)FLUORANTHENE	*3.9E+04*	*2.1E+04*	**810 J**	**3200 J**	**1500 J**	**430 L**	*ND*	**1100 J**
BENZO(A)PYRENE	*3.9E+02*	*2.1E+02*	**1100 J**	**130 J**	**1400 J**	**470 L**	*ND*	**2000 J**
INDENO(1,2,3-CD)PYRENE	*3.9E+03*	*2.1E+03*	**700 J**	**2600 J**	**240 J**	**73 J**	*ND*	**190 J**
DIBENZO(A,H)ANTHRACENE	*3.9E+02*	*1.3E+02*	**280 J**	**1000 J**	**300 J**	*ND*	*ND*	**350 J**
BENZO(G,H,I)PERYLENE	*3.1E+06*	--	**780 J**	**3000 J**	**1200 J**	**400 L**	*ND*	**920 J**

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards or MDE Clean Up Standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

TABLE 19: SEMIVOLATILE ORGANIC COMPOUNDS IN DEEP SOIL SAMPLES

Detected Analytes (ug/kg)	MDE Cleanup Standards	EPA RBC (non-res)	SB-01-05 Background	SB-02-16	SB-03-28	SB-06-19	SB-06-29	SB-15-13
BENZALDEHYDE	--	1.0E+08	ND	ND	660 J	ND	ND	ND
PHENOL	3.1E+07	1.8E+08	ND	ND	ND	ND	ND	210 J
4-METHYLPHENOL	5.1E+05	--	ND	ND	ND	ND	ND	1200 J
NAPHTHALENE	2.0E+06	1.8E+04	4600+	4400+	730 J	13000+	330	23000+
CAPROLACTAM	--	3.1E+08	ND	ND	620 J	ND	ND	ND
2-METHYLNAPHTHALENE	4.1E+05	4.1E+06	1200	1500	360 J	8500+	96 J	6800+
2,4,5-TRICHLOROPHENOL	1.0E+07	6.2E+07	ND	ND	280 J	ND	ND	ND
1,1'-BIPHENYL	--	5.1E+07	110 J	120 J	ND	2400	ND	1300 J
DIMETHYLPHTHALATE	--	--	200 J	ND	370 J	ND	ND	ND
ACENAPHTHYLENE	6.1E+06	--	200 J	110 J	ND	14000+	ND	1900 J
ACENAPHTHENE	6.1E+06	3.3E+07	290	290	460 J	ND	ND	7900+
4-NITROPHENOL	--	--	ND	ND	850 J	ND	ND	ND
DIBENZOFURAN	1.0E+05	--	180 J	230	440 J	11000+	ND	7900+
2,4-DINITROTOLUENE	2.0E+05	5.5+03	ND	ND	550 J	ND	ND	ND
DIETHYLPHTHALATE	8.2E+07	4.9E+08	82 J	2700	670 J	ND	ND	ND
FLUORENE	4.1E+06	2.2E+07	380	390	550 J	13000+	ND	12000+
4-CHLOROPHENYL-PHENYLETHER	--	--	ND	ND	310 J	ND	ND	ND
N-NITROSODIPHENYLAMINE	5.8E+05	3.5E+05	ND	ND	570 J	ND	ND	ND
4-BROMOPHENYL-PHENYLETHER	--	--	ND	ND	460 J	ND	ND	ND
HEXACHLOROBENZENE	1.8E+03	1.1E+03	ND	ND	580 J	ND	ND	ND
ATRAZINE	1.3E+04	7.5E+03	ND	ND	840 J	ND	ND	ND
PENTACHLOROPHENOL	2.4E+04	2.7E+03	ND	ND	490 J	ND	ND	ND
PHENANTHRENE	3.1E+07	--	1700	1600	1500	34000+ J	97 J	42000+
ANTHRACENE	3.1E+07	1.7E+08	490	410	820 J	2600	ND	13000+
CARBAZOLE	1.4E+05	--	180 J	170 J	1100	890	ND	9700+
DI-N-BUTYLPHTHALATE	1.0E+07	6.2E+07	220	160 J	1100	ND	ND	ND
FLUORANTHENE	4.1E+06	2.2E+07	1900	1300	1600 L	8500+	100 J	34000+
PYRENE	3.1E+06	1.7E+07	2500+	1500	1600 L	6600+	120 J	30000+
BUTYLBENZYLPHTHALATE	--	9.1E+05	3100 J	1400	1200	5800+ J	ND	260 J
BENZO(A)ANTHRACENE	3.9E+03	2.1E+03	1500 J	730	1200 L	1400	46 J	19000+
CHRYSENE	3.9E+05	2.1E+05	1300 J	920	1200 L	1600	54 J	16000+
BIS(2-ETHYLHEXYL)PHTHALATE	2.0E+05	1.2E+05	30000+	2000	3800	1700	130 J	930 J
DI-N-OCTYLPHTHALATE	--	--	2600 J	200 J	1100	ND	ND	ND
BENZO(B)FLUORANTHENE	3.9E+03	2.1E+03	1100 J	750	950	630 L	55 J	14000+
BENZO(K)FLUORANTHENE	3.9E+04	2.1E+04	810 J	350	1100	770 L	ND	4600+
BENZO(A)PYRENE	3.9E+02	2.1E+02	1100 J	660	1100	550 L	ND	11000+
INDENO(1,2,3-CD)PYRENE	3.9E+03	2.1E+03	700 J	430	760 J	94 J	ND	4200+
DIBENZO(A,H)ANTHRACENE	3.9E+02	1.3E+02	280 J	140 J	770 J	ND	ND	2500 J
BENZO(G,H,I)PERYLENE	3.1E+06	--	780 J	500	810 J	380 L	ND	3900+ J
2,3,4,6-TETRACHLOROPHENOL	--	1.8E+07	ND	ND	560 J	ND	ND	ND

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards or MDE Clean Up Standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

TABLE 20: GW SERIES SOIL SAMPLES – SEMIVOLATILE ORGANIC COMPOUNDS

Detected Analytes (ug/kg)	MDE Cleanup Standards	EPA RBC (non-res)	SB-01-05 Background	GW-03-00	GW-04-11	GW-05-01	GW-07-06	GW-09-09	GW-11-01	GW-11-04	GW-12-11
1,1'-BIPHENYL	--	5.1E+07	110 J	ND	ND	ND	150 J	ND	ND	ND	ND
BENZALDEHYDE	--	1.0E+08	ND	1300	ND	ND	ND	ND	ND	ND	ND
NAPHTHALENE	2.0E+06	1.8E+04	4600+	ND	110 J	ND	160 J	110 J	ND	94 J	ND
2-METHYLNAPHTHALENE	4.1E+05	4.1E+06	1200	260 J	67 J	ND	670	ND	ND	ND	ND
ACENAPHTHYLENE	6.1E+06	--	200 J	460 J	ND	ND	54 J	ND	ND	ND	ND
ACENAPHTHENE	6.1E+06	3.3E+07	290	960	260	ND	710	ND	ND	ND	ND
DIBENZOFURAN	1.0E+05	--	180 J	970	58 J	ND	450	ND	ND	ND	ND
FLUORENE	4.1E+06	2.2E+07	380	1500	84 J	ND	510	ND	ND	ND	ND
PHENANTHRENE	3.1E+07	--	1700	11000	520 J	79 J	1200	190 J	82 J	81 J	ND
ANTHRACENE	3.1E+07	1.7E+08	490	3600	120 J	ND	270	ND	ND	ND	ND
CARBAZOLE	1.4E+05	--	180 J	790 J	66 J	ND	100 J	ND	ND	ND	ND
DI-N-BUTYLPHTHALATE	1.0E+07	6.2E+07	220	690 J	ND	ND	ND	ND	ND	ND	ND
FLUORANTHENE	4.1E+06	2.2E+07	1900	11000 K	800 J	110 J	1300	150 J	130 J	92 J	ND
PYRENE	3.1E+06	1.7E+07	2500+	10000 K	640	ND	1300	150 J	ND	ND	ND
BUTYLBENZYLPHTHALATE	--	9.1E+05	3100 J	170000+	2100	ND	1500	ND	ND	ND	ND
BENZO(A)ANTHRACENE	3.9E+03	2.1E+03	1500 J	6800 K	390	ND	660	ND	ND	ND	ND
CHRYSENE	3.9E+05	2.1E+05	1300 J	7600 K	390	ND	740	120 J	ND	ND	ND
BIS(2-ETHYLHEXYL)PHTHALATE	2.0E+05	1.2E+05	30000+	8800	600	ND	ND	2200	ND	ND	ND
DI-N-OCTYLPHTHALATE	--	--	2600 J	570 J	81 J	ND	ND	ND	ND	ND	ND
BENZO(B)FLUORANTHENE	3.9E+03	2.1E+03	1100 J	7900	460	ND	510 L	ND	ND	ND	ND
BENZO(K)FLUORANTHENE	3.9E+04	2.1E+04	810 J	2700	210	ND	490 L	ND	ND	ND	ND
BENZO(A)PYRENE	3.9E+02	2.1E+02	1100 J	4300	270	ND	ND	ND	ND	ND	ND
INDENO(1,2,3-CD)PYRENE	3.9E+03	2.1E+03	700 J	3900	210	ND	220 L	ND	ND	ND	ND
DIBENZO(A,H)ANTHRACENE	3.9E+02	1.3E+02	280 J	1600	77 J	ND	74 J	ND	ND	ND	ND
BENZO(G,H,I)PERYLENE	3.1E+06	--	780 J	3600	250	ND	280 L	ND	ND	ND	ND

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards or MDE Clean Up Standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

TABLE 21: PESTICIDES AND PCBS IN SURFACE SOIL SAMPLES

Detected Analytes (ug/kg)	MDE Cleanup Standards	EPA RBC (non-res)	SB-01-00 Background	SB-02-00	SB-03-00	SB-04-00	SB-05-00	SB-06-00	SB-10-00	SB-11-00	SB-12-00
ALPHA-BHC	450	270	ND	ND	ND	ND	ND	4.0 J	ND	ND	ND
BETA-BHC	1600	960	ND	ND	ND	ND	ND	1.7 J	ND	ND	ND
DELTA-BHC	2200	--	ND	ND	ND	6.7 J	12 J	17 J	ND	ND	ND
LINDANE	2200	2100	ND	ND	ND	ND	1.1 J	ND	ND	ND	ND
HEPTACHLOR	640	380	ND	ND	ND	ND	ND	54 J	ND	1.3 J	ND
ALDRIN	170	100	ND	ND	ND	ND	1.5 J	4.8 J	ND	ND	ND
HEPTACHLOR EPOXIDE	310	190	ND	ND	250 J	2.1 J	5.9 J	2.1 J	ND	ND	ND
ENDOSULFAN I	6.1E+05	3.7E+06	ND	ND	ND	ND	1.6 J	12 J	ND	ND	ND
DIELDRIN	180	110	ND	ND	480 J	9.0 J	20 J	43 J	ND	ND	ND
4,4-DDE	8400	5100	ND	ND	ND	96+	270+	39 J	5.1	ND	5.5 J
ENDRIN	31,000	180,000	ND	ND	160 J	ND	3.0 J	16	ND	ND	ND
ENDOSULFAN II	6.1E+05	--	ND	ND	58 J	ND	2.2 J	49 J	ND	ND	ND
4,4'-DDD	12,000	7200	6.3 J	ND	1500+ J	57	88+	21 J	ND	ND	19
ENDOSULFAN SULFATE	6.1E+05	--	ND	ND	ND	ND	ND	9.2 J	ND	ND	ND
4,4'-DDT	8400	7000	7.7 J	2.0 J	1900+	72+	340+	190+	8.6	5.8 J	31
METHOXYCHLOR	5.1E+05	3.1E+06	ND	ND	ND	ND	ND	10 J	ND	ND	ND
ENDRIN KETONE	31,000	--	2.6 J	ND	ND	2.1 J	15 J	21 J	ND	ND	ND
ENDRIN ALDEHYDE	31,000	--	3.5 J	ND	620 J	6.6 J	18 J	15 J	ND	ND	3.6 J
ALPHA-CHLORDANE	8200	6500	ND	ND	ND	7.4	6.7 J	30+ J	ND	ND	ND
GAMMA-CHLORDANE	8200	6500	ND	ND	ND	3.5 J	3.7 J	20 J	ND	ND	3.3 J
TOXAPHENE	2600	1600	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR-1242	1400	740	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR-1254	1400	740	ND	ND	20000+ J	ND	ND	980+ J	ND	140	340
AROCLOR-1260	1400	740	130 J	ND	62000+	ND	ND	2600+	ND	ND	ND

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards or MDE Clean Up Standards. Red indicates significant; --: MDE or EPA has not established Cleanup Standards

TABLE 21 (Cont.): PESTICIDES AND PCBS IN SUBSURFACE SOIL SAMPLES

Detected Analytes (ug/kg)	MDE Cleanup Standards	EPA RBC (non-res)	SB-01-05 Background	SB-02-05	SB-03-10	SB-07-08	SB-16-05	SB-02-16	SB-03-28	SB-06-19	SB-06-29	SB-11-02	SB-15-13
ALPHA-BHC	450	270	2.1 J	100+	ND	2.4 J	ND	1.7 J	ND	ND	ND	ND	ND
BETA-BHC	1600	960	11 J	2.8 J	38 J	1.1 J	2.3 J	10 J	12	1.6 J	ND	ND	ND
DELTA-BHC	2200	--	31	9.8 J	180+ J	1.3 J	12 J	20+	11 J	ND	ND	2.1 J	1.2 J
LINDANE	2200	2100	ND	ND	7.8 J	ND	1.3 J	1.8 J	ND	1.9 J	ND	ND	2.9 J
HEPTACHLOR	640	380	12	37 J	59+ J	1.7 J	3.0 J	9.6 J	1.9 J	ND	ND	ND	4.8 J
ALDRIN	170	100	ND	20 J	44 J	2.1 J	ND	2.0 J	ND	ND	ND	ND	ND
HEPTACHLOR EPOXIDE	310	190	29	58	140+ J	2.8 J	10	18 J	1.2 J	2.2 J	2.1 J	ND	2.3 J
ENDOSULFAN I	6.1E+05	3.7E+06	3.2 J	ND	19 J	ND	ND	ND	1.5 J	ND	ND	ND	2.0 J
DIELDRIN	180	110	19	12 J	53+ J	2.3 J	ND	ND	9.2 J	ND	ND	ND	10 J
4,4-DDE	8400	5100	18 J	7.3 J	69+ J	ND	4.2 J	ND	7.3 J	ND	ND	ND	12 J
ENDRIN	31,000	180,000	3.8 J	ND	17 J	ND	ND	ND	ND	ND	ND	ND	7.1 J
ENDOSULFAN II	6.1E+05	--	2.2 J	ND	18 J	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD	12,000	7200	35+ J	15 J	47+ J	6.0	2.4 J	3.1 J	9.9 J	ND	ND	4.2 J	23 J
ENDOSULFAN SULFATE	6.1E+05	--	19 J	12 J	17 J	ND	4.8 J	2.5 J	4.4 J	2.6 J	ND	4.6 J	3.8 J
4,4'-DDT	8400	7000	39 J	60 J	96+ J	4.1 J	7.1 J	11 J	17 J	4.7 J	2.5 J	6.1 J	18 J
METHOXYCHLOR	5.1E+05	3.1E+06	52 J	46 J	250 J	ND	ND	ND	40 J	ND	ND	ND	9.8 J
ENDRIN KETONE	31,000	--	ND	9.3 J	10 J	ND	3.5 J	ND	6.2	3.2 J	ND	ND	20 J
ENDRIN ALDEHYDE	31,000	--	45 J	24 J	52+ J	ND	ND	3.6 J	4.0 J	450+ J	ND	4.2 J	4.2 J
ALPHA-CHLORDANE	8200	6500	19	6.6 J	46+ J	2.6 J	ND	1.4 J	1.6 J	1.4 J	ND	ND	27 J
GAMMA-CHLORDANE	8200	6500	17 J	ND	20 J	2.2 J	ND	ND	ND	ND	ND	ND	13 J
TOXAPHENE	2600	1600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR-1242	1400	740	1000+	ND	17000+	ND	740+	450	ND	ND	ND	ND	ND
AROCLOR-1254	1400	740	1100+	3000+	11000+	140 J	340	ND	250 J	ND	ND	ND	ND
AROCLOR-1260	1400	740	ND	1600 J	ND	ND	ND	ND	150 J	ND	ND	120	66 J

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

TABLE 22: PESTICIDES AND PCBS IN GW SERIES SOIL SAMPLES

Detected Analytes (ug/kg)	MDE Cleanup Standards	EPA RBC (non-res)	SB-01-05 Background	GW-03-00	GW-04-11	GW-05-01	GW-07-06	GW-09-09	GW-11-01	GW-11-04	GW-12-11
ALPHA-BHC	450	270	2.1 J	ND	ND	ND	ND	ND	ND	ND	ND
BETA-BHC	1600	960	11 J	6.5	ND	ND	ND	ND	ND	ND	ND
DELTA-BHC	2200	--	31	3.6 J	ND	ND	ND	ND	ND	ND	ND
LINDANE	2200	2100	ND	3.4 J	ND	ND	1.5 J	ND	ND	ND	ND
HEPTACHLOR	640	380	12	19	ND	ND	ND	ND	ND	ND	ND
ALDRIN	170	100	ND	2.5 J	ND	ND	1.0 J	ND	ND	ND	ND
HEPTACHLOR EPOXIDE	310	190	29	32 J	1.2 J	ND	ND	ND	ND	ND	ND
ENDOSULFAN I	6.1E+05	3.7E+06	3.2 J	3.5 J	ND	ND	ND	ND	ND	ND	ND
DIELDRIN	180	110	19	25 J	ND	ND	16	ND	ND	ND	ND
4,4-DDE	8400	5100	18 J	59	ND	ND	7.1 J	ND	ND	ND	ND
ENDRIN	31,000	180,000	3.8 J	7.1 J	ND	ND	2.2 J	ND	ND	ND	ND
ENDOSULFAN II	6.1E+05	--	2.2 J	5.5 J	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD	12,000	7200	35+ J	46+ J	6.7	ND	42 J	ND	4.9 J	ND	ND
ENDOSULFAN SULFATE	6.1E+05	--	19 J	3.2 J	ND	ND	2.6 J	ND	ND	ND	ND
4,4'-DDT	8400	7000	39 J	170+	3.3 J	4.3 J	36 J	ND	5.5 J	ND	ND
METHOXYCHLOR	5.1E+05	3.1E+06	52 J	33 J	ND	ND	ND	ND	ND	ND	ND
ENDRIN KETONE	31,000	--	ND	18	ND	ND	5.6 J	ND	ND	ND	ND
ENDRIN ALDEHYDE	31,000	--	45 J	34 J	ND	ND	14	ND	ND	ND	ND
ALPHA-CHLORDANE	8200	6500	19	220+ J	4.1 J	ND	1.8 J	ND	ND	ND	ND
GAMMA-CHLORDANE	8200	6500	17 J	210+	2.9 J	ND	1.6 J	ND	ND	ND	ND
TOXAPHENE	2600	1600	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR-1242	1400	740	1000+	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR-1254	1400	740	1100+	2400+ J	ND	ND	480	ND	ND	ND	ND
AROCLOR-1260	1400	740	ND	1400+	280	120 J	860+	ND	250	ND	ND

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed November 2010 EPA standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

7.3 Surface Water Sampling Results

Three samples plus one duplicate sample were collected from Cabin Branch Creek. Samples SW-4 and DM-SW-4 were duplicates of Samples SW-2 and DM-SW-2. Sample SW-1 was the upstream background surface water sample for this investigation. Aluminum was detected in the upstream samples in levels greater than the freshwater screening guidelines. Barium, iron and manganese were detected in all total metals samples in levels greater than the EPA BTAG freshwater screening benchmark. Magnesium and sodium were detected in the downstream sample at a level greater than their respective BTAGs. Chromium was elevated in sample SW-2 and at 10.1 ug/l was just above the CRQL for chromium.

In the filtered samples barium and manganese continued to be identified in levels greater than the BTAG in all samples. Magnesium, potassium and sodium were identified in the downstream samples at levels greater than the BTAG. Potassium was identified in levels greater than its SQL. There were no other significant trends detected in surface water samples

Table 23: Detected Total Inorganics in Surface Water

Detected Analytes (µg/L)	EPA BTAG	SW-1 Background	SW-2	SW-3	SW-4
ALUMINUM	*87*	**445 K**	**412 K**	*ND*	**423 K**
BARIUM	*4*	**59.2 J**	**60.3 J**	**67.2 J**	**60.7 J**
CHROMIUM	*85*	*ND*	**10.1**	**0.73 J**	**9.5 J**
IRON	*300*	**1210**	**1230**	**350**	**1220**
LEAD	*2.5*	**2.3 J**	**2.1 J**	*ND*	**2.4 J**
MAGNESIUM	*82000*	*ND*	*ND*	**128000**	*ND*
MANGANESE	*120*	**172**	**209**	**240**	**208**
POTASSIUM	*53000*	*ND*	*ND*	**52700 J**	*ND*
SODIUM	*680000*	*ND*	**180000**	**1020000+**	**186000**

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Red = significant level of contaminant; Analytes highlighted in yellow exceed July 2006 EPA BTAG standards. --: MDE or EPA has not established Cleanup Standards

Table 24: Detected Dissolved Inorganics in Surface Water

Detected Analytes (µg/L)	EPA BTAG	DM-SW-1 Background	DM-SW-2	DM-SW-3	DM-SW-4 (dup SW-02)
BARIUM	*4*	55.7 J	56.3 J	58.9 J	55.3 J
CHROMIUM	*85*	*ND*	2.3 J	*ND*	1.8 J
IRON	*300*	134	75.0 J	*ND*	81.4 J
LEAD	*2.5*	*ND*	1.6 J	*ND*	*ND*
MAGNESIUM	*82000*	*ND*	*ND*	132000	*ND*
MANGANESE	*120*	157	198	234	194
POTASSIUM	*53000*	*ND*	8250 J	55200 J	8520 J
SODIUM	*680000*	*ND*	190000	986000+	194000

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Red = significant level of contaminant; Analytes highlighted in yellow exceed July 2006 EPA BTAG standards. --: MDE or EPA has not established Cleanup Standards

Table 25: Detected VOCS in Surface Water

Detected Analytes (µg/L)	EPA BTAG	SW-1 Background	SW-2	SW-3	SW-4 (dup SW-02)
ACETONE	*1500*	*ND*	16 J	*ND*	*ND*

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Red = significant level of contaminant; Analytes highlighted in yellow exceed July 2006 EPA BTAG standards. --: MDE or EPA has not established Cleanup Standards

Table 26: Pesticide Detections in Surface Water

Detected Analytes (ug/kg)	EPA BTAG	SW-01 Background	SW-02	SW-03	SW-04 (dup SW-02)
HEPTACHLOR EPOXIDE	0.0019	*ND*	*ND*	0.037 J	*ND*

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed July 2006 EPA BTAG standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

7.4 Sediment Sampling Results

Sediment samples were collected in the same locations as the surface water samples. Samples were obtained from the top 12 inches of sediment substrate using a three inch diameter bucket auger. The samples were labeled SED-01, SED-02, SED-03 and SED-04 and analyzed for a full scan of organic and inorganic parameters including TAL metals, TCL volatile organics, semivolatile organic compounds, and pesticides and PCBs. SED-04 was a duplicate of SED-02. SED-01 was the site background sample.

The only detections were for metals and SVOCs. Chromium, lead, selenium and cyanide were detected in levels greater than regulatory limits. Chromium was detected in significantly elevated levels in all downstream samples and was above the BTAG in SED-02 and its duplicate SED-04. All downstream metals samples identified inorganics at levels significantly greater than those found in the background sample.

Table 27: Inorganics in Sediments

Detected Analytes (mg/kg)	EPA BTAG	SED-01 Background	SED-02	SED-03	SED-04 (dup SED-02)
ALUMINUM	--	1740	10600	8700	9380
ANTIMONY	2	*ND*	*ND*	0.85 J	*ND*
ARSENIC	9.8	0.79 J	7.0	9.3	5.5
BARIUM	--	11.4 J	52.8	60.5	54.7
CADMIUM	0.99	*ND*	0.31 J	0.2 J	0.34 J
CHROMIUM	43.4	7.1	340	34.4	509
COBALT	50	1.2 J	5.4 J	3.0 J	5.1 J
IRON	20000	3800	16300	12400	13200
LEAD	35.8	14.8 L	40.7 L	29.0 L	45.0 L
MANGANESE	460	44.0	184	175	186
MERCURY	0.18	*ND*	0.18	0.12 J	0.18
NICKEL	22.7	1.8 J	11.2	6.5	10.6
SELENIUM	2	*ND*	*ND*	4.0 J	*ND*
VANADIUM	--	8.1	30.9	26.6	30.1
ZINC	121	16.4	68.3	32.7	80.6
CYANIDE	0.1	*ND*	*ND*	0.61 J	*ND*

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed July 2006 BTAG levels. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

The sample collected at SED-01 had the highest elevations of semivolatile organic compounds. Napthalene, 2-methylnaphthalene, bis(2-ethylhexyl)phthalate and indeno(1,2,3-cd)pyrene were detected in levels above regulatory guidelines in the SED-01 sample. Sample SED-03 exhibited elevated levels of benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene and dibenzo(a,h)anthracene above the BTAG guidelines. Benzo(b)fluoranthene was identified in SED-03 at a level significantly above background and greater than the BTAG. There were no other significant detections of SVOC in levels greater than background or the corresponding sample quanitation limits.

Hexavalent chromium was identified in SED-02 and its duplicate (SED-4) at levels significantly above the sample quantitation limit but below the BTAG level.

Table 28: Semivolatile Organics in Sediments

Detected Analytes (ug/kg)	EPA BTAG	SED-01 Background	SED-02	SED-03	SED-04 (dup SED-02)
NAPTHALENE	176	**210**	*ND*	*ND*	*ND*
2-METHYLNAPHTHALENE	20.2	**140 J**	*ND*	*ND*	*ND*
1,1'-BIPHENYL	1220	**240**	*ND*	*ND*	*ND*
PHENANTHRENE	204	*ND*	**57 J**	**49 J**	*ND*
ANTHRACENE	57.2	*ND*	*ND*	**53 J**	*ND*
DI-N-BUTYLPHTHALATE	6470	**100 J**	*ND*	*ND*	*ND*
FLUORANTHENE	423	**150 J**	**170 J**	**150 J**	**120 J**
PYRENE	195	**130 J**	**160 J**	**170 J**	**110 J**
BIS(2-ETHYLHEXYL)PHTHALATE	180	**7000+**	**160 J**	*ND*	**74 J**
DI-N-OCTYLPHTHALATE	--	**700**	*ND*	*ND*	*ND*
BENZO(B)FLUORANTHENE	27.2	*ND*	*ND*	**250**	*ND*
BENZO(K)FLUORANTHENE	240	**67 J**	**79 J**	**150 J**	*ND*
INDENO(1,2,3-CD)PYRENE	17	**58 J**	**59 J**	**120 J**	*ND*
DIBENZO(A,H)ANTHRACENE	33	*ND*	*ND*	**45 J**	*ND*
BENZO(G,H.I)PERYLENE	170	**170 J**	*ND*	**120 J**	*ND*

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed July 2006 EPA BTAG standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

Figure 29: Hexavalent Chromium Data for Sediments

Detected Analytes (mg/kg)	EPA BTAG	SED-01 Background	SED-02	SED-03	SED-04 (dup SED-02)
CHROMIUM+6	43.4 (Chromium)	*ND* (SQL=0.5)	**3.2**	*ND*	**1.2**

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed July 2006 EPA BTAG standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

Table 30: Pesticides In Sediment Samples

Detected Analytes (ug/kg)	EPA BTAG	SED-01 Background	SED-02	SED-03	SED-04 (dup SED-02)
Endosulfan Sulfate	5.4	*ND*	*ND*	*ND*	**3.1 J**

Qualifier: J – Analyte present, but reported value may not be accurate or precise; K – Analyte present, reported value biased high, actual value is expected to be lower; R – Unreliable result; B – Not detected substantially above field blank; L – Analyte present, value biased low, value expected to be higher. ND: Not detected. Analytes highlighted in yellow exceed July 2006 EPA BTAG standards. **Red** indicates significant; --: MDE or EPA has not established Cleanup Standards

TOXICOLOGICAL EVALUATION SUMMARY OF RISKS

MDE performed a toxicological evaluation of the data obtained from the June 2010 Drumco SI sampling event, EPA's CLP Routine Analytic Services Case # 40014 and Delivery of Analytical Services Case Number R33452 (for hexavalent chromium analyses). The major highlights regarding the preparation of the evaluation are as follows:

- A commercial use scenario was assumed for the purpose of estimating risk to potentially exposed populations.
- The potentially exposed populations considered were the child visitor, youth visitor, adult worker and construction worker.
- Exposures to soil, groundwater, surface water, sediments and vapors were considered.
- The potential exposure routes considered for soil were ingestion, inhalation, dermal contact, and vapor intrusion of volatiles into indoor air.
- The potential exposure routes considered for groundwater were ingestion, inhalation, dermal contact, and vapor intrusion of volatiles into indoor air.
- The potential exposure routes considered for surface water were ingestion, inhalation and dermal contact.
- Risks from vapor intrusion of volatile and semi-volatile contaminants from soil and groundwater into indoor air were evaluated using the Johnson and Ettinger Tier I vapor intrusion model.
- Hazard indices and cancer risk values were calculated two ways; risk evaluations for residential populations using maximum detected concentrations, and risk evaluations using 95% upper confidence limit (UCL) concentrations for soil as the site-wide average concentration.

The purpose of the toxicological evaluation is to examine the human health risks associated with the Drumco property. The site was evaluated for child visitor (1-6 years), youth visitor (6-17), adult worker and construction worker populations under a commercial future use scenario. This toxicological evaluation evaluated risks to commercial use populations only. Residential use scenarios are expected to have greater levels of risk and should be evaluated to reflect changes in future land use. The United States Environmental Protection Agency (EPA) has recommended default exposure parameters that were used to estimate cumulative risk from all chemicals. EPA recognizes a Hazard Index (HI) values of less than or equal to 1 (noncarcinogenic chemicals) and an excess lifetime cancer risk (CR) less than or equal to 10^{-6} to 10^{-4} as acceptable. The Maryland Department of the Environment (MDE) recognizes an HI value of less than or equal to 1 and an excess lifetime cancer risk less than or equal to 10^{-6} to 10^{-5} as acceptable. Risks to ecological receptors were evaluated by comparing groundwater and surface water contaminant concentrations to ambient surface water quality criteria values to evaluate potential impact to nearby surface water. Sediment contaminant concentrations were

compared to effects range-median values to evaluate potential impact to sediment dwelling receptors. Based on these exposures, estimated risks at the site were compared to MDE and EPA recommended levels, and the following conclusions were reached:

The estimated risks from the incidental ingestion of detected noncarcinogenic surface soil contaminants exceeded MDE and EPA recommended risk levels for all commercial populations using the maximum detected concentrations as the site-wide average concentrations. The estimated risks from the incidental ingestion of detected noncarcinogenic surface soil contaminants exceeded MDE and EPA recommended risk levels for the child visitor, youth visitor and construction worker commercial populations using the 95% UCL concentrations as the site wide average concentrations. The estimated risks from the incidental ingestion of detected noncarcinogenic surface soil contaminants were below MDE and EPA recommended risk levels for the adult worker population. The estimated risks from the incidental ingestion of detected carcinogenic surface soil contaminants exceeded MDE recommended risk ranges for all commercial populations and EPA recommended risk ranges for the child visitor population using the maximum detected concentrations and 95% UCL concentrations as the site-wide average concentrations. The estimated risks from the incidental ingestion of detected carcinogenic surface soil contaminants were below EPA recommended risk ranges for the adult worker, youth visitor and construction worker commercial populations using the maximum detected concentrations and 95% UCL concentrations as the site-wide average concentrations. Noncarcinogenic risk estimates for the incidental ingestion of detected subsurface soil contaminants exceeded MDE and EPA recommend risk levels for the child visitor and construction worker commercial populations using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations. The estimated risks from the incidental ingestion of detected noncarcinogenic subsurface soil contaminants were below MDE and EPA recommended risk levels for the youth visitor and adult worker populations using the maximum detected concentrations and 95% UCL concentrations as the site-wide average concentrations. Risk estimates for the incidental ingestion of detected carcinogenic subsurface soil contaminants exceeded MDE recommended risk ranges for the all commercial populations. Subsurface soil incidental ingestion risk estimates were within MDE recommended risk ranges for the construction worker population and EPA recommended risk ranges for all commercial populations using the 95% UCL concentrations as the site-wide average concentrations.

The estimated noncarcinogenic risks from the inhalation of detected and nondetected volatiles and fugitive dust from surface soils were within acceptable levels as recommended by MDE and EPA for all commercial populations using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations. The estimated carcinogenic risks from the inhalation of detected volatiles and fugitive dust from surface soils exceeded recommended MDE risk ranges for the adult worker commercial population using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations. The estimated carcinogenic risks from the inhalation of detected volatiles and fugitive dust from surface soils were within MDE acceptable risk ranges for the child visitor, youth visitor and construction worker commercial populations and EPA recommended risk ranges for all commercial populations. The estimated noncarcinogenic risks from the inhalation of detected volatiles and fugitive dust from subsurface soils were within acceptable levels as recommended by MDE and EPA for all commercial populations using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average

concentrations, however, detection limits were elevated in several samples leading to a higher degree of uncertainty when evaluating this exposure pathway. The estimated carcinogenic risks from the inhalation of detected volatiles and fugitive dust from subsurface soils exceeded MDE recommended risk ranges for the adult worker commercial population using the maximum detected concentrations as the site-wide average concentrations. The estimated carcinogenic risks from the inhalation of detected volatiles and fugitive dust from subsurface soils were within acceptable MDE risk ranges for the child visitor, youth visitor and construction worker commercial populations and EPA recommended risk ranges for all commercial populations using the maximum detected concentrations as the site-wide average concentrations. The estimated carcinogenic risks from the inhalation of detected volatiles and fugitive dust from subsurface soils were within MDE and EPA recommended risk ranges for the adult worker commercial population using the 95% UCL concentrations as the site-wide average concentrations.

Risk estimates for dermal exposure to detected noncarcinogenic surface soil contaminants exceeded MDE and EPA recommended risk levels for all commercial populations using the maximum detected concentrations and the 95% UCL as the site-wide average concentrations. Risk estimates for dermal exposure to detected carcinogenic surface soil contaminants exceeded MDE recommended risk ranges for all commercial populations using the maximum detected concentrations and the 95% UCL as the site-wide average concentrations. Risk estimates for dermal exposure to detected carcinogenic surface soil contaminants were below MDE recommended risk ranges for the adult worker commercial population and EPA recommended risk ranges for the child visitor and construction worker commercial populations using both the 95% UCL concentrations as the site-wide average concentrations. Risk estimates for dermal exposure to detected noncarcinogenic subsurface soil contaminants exceeded MDE and EPA recommended risk ranges for the child visitor and construction worker commercial populations using maximum detected concentrations as the site-wide average concentrations. Risk estimates for dermal exposure to detected noncarcinogenic subsurface soil contaminants were below MDE and EPA recommended risk ranges for the youth visitor and adult worker commercial populations using maximum detected concentrations as the site-wide average concentrations. Risk estimates for dermal exposure to detected and nondetected noncarcinogenic subsurface soil contaminants were below MDE and EPA recommended risk levels for all commercial populations using the 95% UCL concentrations as the site-wide average concentrations. Risk estimates for dermal exposure to detected carcinogenic subsurface soil contaminants exceeded MDE recommended risk ranges for the child visitor and adult worker commercial populations using both the 95% UCL and the maximum detected concentrations as the site-wide average concentrations. Risk estimates for dermal exposure to detected carcinogenic subsurface soil contaminants were within MDE recommended risk ranges for the construction worker commercial populations and EPA recommended risk ranges for all commercial populations using both the maximum detected concentrations and the 95% UCL as the site-wide average concentrations.

The maximum concentration of lead detected in soils on site, exceeded the 400 mg/kg residential and 1000 mg/kg MDE nonresidential soil screening values. The mean surface soil, subsurface soil and total lead concentrations on site were 200, 401 and 323 mg/kg respectively. Based upon these results, lead contamination in the specific sampling locations may pose a threat to the health of sensitive populations and the environment.

The estimated risk from incidental ingestion of detected and nondetected, noncarcinogenic and carcinogenic contaminants in sediment were below MDE and EPA recommended levels of risk for all commercial populations using the maximum detected concentrations as the site-wide average concentration. Noncarcinogenic and carcinogenic risk estimates for dermal contact with detected and nondetected contaminants in sediment were below MDE and EPA recommended risk levels for all commercial populations. The maximum concentration of lead detected in sediment on site was less than the 400 mg/kg residential soil screening value. Based on the available data the concentrations of lead in sediment should not pose a threat to the health of sensitive populations and the environment. No detected contaminant or nondetected contaminant exceeded its respective NOAA ERM value.

Groundwater at the site is not used as a potable water supply, and public drinking water is available. The evaluation of groundwater as a potable water supply is provided for comparative purposes only. Potential adverse effects from groundwater exposure were evaluated utilizing dissolved metals and total metals concentration data on site. Risk estimates from the incidental ingestion of detected noncarcinogenic groundwater contaminants exceeded MDE and EPA recommended risk levels for all commercial populations using both total and dissolved metals data. Risk estimates from the incidental ingestion of detected carcinogenic groundwater contaminants exceeded MDE and EPA recommended risk ranges for all commercial populations using total metals data. Multiple detected contaminants were the carcinogenic groundwater ingestion risk drivers using the total metals data set. Risk estimates from the incidental ingestion of detected carcinogenic groundwater contaminants exceeded MDE recommended risk ranges for all commercial populations and EPA recommended risk ranges for the adult worker, youth visitor and child visitor commercial populations using the dissolved metals data. Risk estimates from the incidental ingestion of detected carcinogenic groundwater contaminants were within EPA recommended risk ranges for the construction worker population using the dissolved metals data set.

Risk estimates for dermal contact with detected noncarcinogenic groundwater contaminants exceeded MDE and EPA recommended risk levels for all commercial populations using total metals data. Risk estimates for dermal contact with detected noncarcinogenic groundwater contaminants exceeded MDE and EPA recommended risk levels for the adult worker and construction worker commercial populations using dissolved metals data. Risk estimates for dermal contact with detected noncarcinogenic groundwater contaminants were below MDE and EPA recommended risk levels for the youth visitor commercial population. Risk estimates for dermal contact with detected carcinogenic groundwater contaminants exceeded MDE recommended risk levels for all commercial populations using dissolved metals data. Risk estimates for dermal contact with detected carcinogenic groundwater contaminants exceeded MDE recommended risk ranges for the adult worker, youth visitor and child visitor commercial populations and EPA recommended risk ranges for the adult worker commercial population using both the total and dissolved metals data sets. Risk estimates for dermal contact with detected carcinogenic groundwater contaminants were within MDE recommended risk ranges for the construction worker commercial population and EPA recommended risk ranges for the child visitor, youth visitor and construction worker commercial populations using total and dissolved metals data. The lack of critical physical constants and the methods for derivation of dermal exposures lead to a high degree of uncertainty associated with this route of exposure. This high degree of uncertainty should be considered when evaluating the hazards of dermal exposure to groundwater.

Nine detected groundwater contaminants and eight nondetected analytes exceeded their respective MCL or SMCL. Multiple detected groundwater (dissolved metals) contaminants exceeded the freshwater AWQS or AWQC for the protection of aquatic life (acute or chronic) and human health via fish consumption.

Noncarcinogenic and carcinogenic risk estimates for the incidental ingestion of detected and nondetected surface water (dissolved and total metals) contaminants while swimming were below MDE and EPA recommended risk levels for all populations. Four detected surface water contaminants exceeded the freshwater AWQS or AWQC for the protection of aquatic life (acute or chronic). Two detected surface water contaminants exceeded the freshwater criteria for protection of human health via fish consumption.

No detected contaminant in groundwater exceeded EPA or MDE recommended levels of noncarcinogenic or carcinogenic risks for vapor intrusion. Multiple detected noncarcinogenic and carcinogenic soil contaminants, mercury, Ethylbenzene, xylenes, naphthalene and heptachlor, exceeded a hazard index of one or a cancer risk of 1×10^{-5} for vapor intrusion of volatiles to indoor air.

Multiple detected and nondetected groundwater and surface water contaminants exceeded their corresponding MDE groundwater cleanup standard. Multiple detected and nondetected soil contaminants exceeded their MDE non-residential soil cleanup standard. Two detected sediment contaminants, arsenic and chromium, exceeding their corresponding non-residential soil cleanup standard.

Table 31: Summary table of HI and CR values for each commercial population

Noncarcinogenic Endpoints Detected Contaminants Only			
Population	Pathway	Hazard Index	Risk Drivers
Child visitor	**Ingestion – surface soil**	**17**	**Chromium VI, cobalt, nickel, Arochlor 1254**
Youth visitor	**Ingestion-surface soil**	**3**	**Potential additive effects**
Adult worker	**Ingestion-surface soil**	**2**	**Potential additive effects**
Construction worker	**Ingestion – surface soil**	**17**	**Chromium VI, cobalt, nickel, Arochlor 1254**
Child visitor	**Ingestion – subsurface soil**	**7**	**Arochlor 1254**
Construction worker	**Ingestion – subsurface soil**	**7**	**Arochlor 1254**
Child visitor	**Dermal contact – surface soil**	**19**	**Chromium VI, Arochlor 1254**
Youth visitor	**Dermal contact – surface soil**	**13**	**Chromium VI,**
Adult worker	**Dermal contact – surface soil**	**11**	**Chromium VI,**
Construction worker	**Dermal contact – surface soil**	**16**	**Chromium VI,**
Child visitor	**Dermal contact – subsurface soil**	**2**	**Potential additive effects**
Construction worker	**Dermal contact – subsurface soil**	**2**	**Potential additive effects**
Child visitor	**Ingestion – groundwater (dissolved)**	**29**	**Arsenic, cobalt, iron, manganese, Arochlor-1254, benzene**
Youth visitor	**Ingestion – groundwater (dissolved)**	**22**	**Arsenic, cobalt, iron, manganese, Arochlor-1254**
Adult worker	**Ingestion – groundwater (dissolved)**	**12**	**Arochlor-1254**
Construction worker	**Ingestion – groundwater (dissolved)**	**36**	**Arsenic, chromium, cobalt, iron, manganese, Arochlor-1254, benzene**
Child Visitor	**Dermal contact – groundwater (dissolved)**	**2**	**Potential additive effects**
Adult worker	**Dermal contact – groundwater (dissolved)**	**7**	**Chromium**
Construction worker	**Dermal contact – groundwater (dissolved)**	**4**	**Chromium**

Carcinogenic Endpoints Detected Contaminants Only			
Population	Pathway	Cancer Risk	Risk Drivers
Child visitor	**Ingestion-surface soil**	**2.1×10^{-4}**	**Arochlor-1254, Arochlor-1260, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene dibenzo[a,h]anthracene**
Youth visitor	**Ingestion-surface soil**	**5.3×10^{-5}**	**Arochlor-1260, benzo[a]pyrene**
Adult worker	**Ingestion-surface soil**	**4.4×10^{-5}**	**Arochlor-1260**
Construction worker	**Ingestion – surface soil**	**1.7×10^{-5}**	**Potential additive effects**
Child visitor	**Ingestion-subsurface soil**	**3.3×10^{-4}**	**Arsenic, Arochlor-1242, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene dibenzo[a,h]anthracene**
Youth visitor	**Ingestion-subsurface soil**	**7.1×10^{-5}**	**Benzo[a]pyrene**
Adult worker	**Ingestion-subsurface soil**	**4.4×10^{-5}**	**Benzo[a]pyrene**
Construction worker	**Ingestion – subsurface soil**	**1.7×10^{-5}**	**Potential additive effects**
Adult worker	**Inhalation volatiles and fugitive dust – surface soil**	**4.5×10^{-5}**	**Chromium VI**
Adult worker	**Inhalation volatiles and fugitive dust – surface soil**	**2.37×10^{-5}**	**Ethylbenzene**
Child visitor	**Dermal contact – surface soil**	**6.2×10^{-5}**	**Arochlor-1260, benzo[a]pyrene**
Youth visitor	**Dermal contact – surface soil**	**5.9×10^{-5}**	**Arochlor-1260, benzo[a]pyrene**
Adult worker	**Dermal contact – surface soil**	**7.4×10^{-5}**	**Arochlor-1254, benzo[a]pyrene**
Child visitor	**Dermal contact – subsurface soil**	**9.6×10^{-5}**	**Benzo[a]pyrene, Dibenzo[a,h\anthracene**
Youth visitor	**Dermal contact – subsurface soil**	**7.4×10^{-5}**	**Benzo[a]pyrene**
Adult worker	**Dermal contact – subsurface soil**	**6.4×10^{-5}**	**Arochlor-1242, benzo[a]pyrene**
Child visitor	**Ingestion-groundwater (dissolved)**	**3.2×10^{-4}**	**Arsenic, Arochlor-1242, Aroclor 1254, Aroclor 1260, benzeze, benzo[a]anthracene, ethylbenzene**
Youth visitor	**Ingestion-groundwater (dissolved)**	**4.6×10^{-4}**	**Arsenic, Arochlor-1242, Aroclor 1254,**

Carcinogenic Endpoints Detected Contaminants Only			
Population	Pathway	Cancer Risk	Risk Drivers
			Aroclor 1260, benzeze, benzo[a]anthracene, ethylbenzene
Adult worker	**Ingestion-groundwater (dissolved)**	**5.0×10^{-4}**	**Arsenic, Arochlor-1242, Aroclor 1254, Aroclor 1260, benzeze, benzo[a]anthracene, ethylbenzene**
Construction worker	**Ingestion-groundwater (dissolved)**	**6.0×10^{-5}**	**Arsenic**
Child visitor	**Dermal contact – groundwater (dissolved)**	**1.9×10^{-5}**	**Potential additive effects.**
Youth visitor	**Dermal contact – groundwater (dissolved)**	**2.7×10^{-5}**	**Potential additive effects.**
Adult worker	**Dermal contact – groundwater (dissolved)**	**1.4×10^{-4}**	**Benzene, Dieldrin, DDD, DDT, ethylbenzene**

Table 32: Summary table of Soil HI and CR values utilizing 95% UCL concentrations

Noncarcinogenic Endpoints			
Population	**Pathway**	Hazard Index	Risk Drivers
Child visitor	**Ingestion – surface soil**	**9**	**Chromium VI**
Youth visitor	**Ingestion-surface soil**	**2**	**Potential additive effects**
Construction worker	**Ingestion – surface soil**	**9**	**Chromium VI**
Child visitor	**Ingestion – subsurface soil**	**2**	**Potential additive effects**
Construction worker	**Ingestion – subsurface soil**	**2**	**Potential additive effects**
Child visitor	**Dermal contact – surface soil**	**14**	**Chromium VI**
Youth visitor	**Dermal contact – surface soil**	**10**	**Chromium VI**
Construction worker	**Dermal contact – surface soil**	**8**	**Chromium VI**
Child visitor	**Dermal contact-subsurface soil**	**12**	**Chromium VI**
Carcinogenic Endpoints			
Population	**Pathway**	Cancer Risk	Risk Drivers
Child visitor	**Ingestion-surface soil**	**1.1×10^{-4}**	**Arochlor-1260, benzo[a]pyrene, dibenzo[a,h]anthracene**
Youth visitor	**Ingestion-surface soil**	**3.1×10^{-5}**	**Arochlor-1260**
Adult worker	**Ingestion-surface soil**	**2.7×10^{-5}**	**Arochlor-1260**
Construction worker	**Ingestion – surface soil**	**1.0×10^{-5}**	**Potential additive effects**
Child visitor	**Ingestion-subsurface soil**	**9.3×10^{-5}**	**benzo[a]pyrene**
Youth visitor	**Ingestion-subsurface soil**	**2.0×10^{-5}**	**Potential additive effects**
Adult worker	**Ingestion-subsurface soil**	**1.3×10^{-5}**	**Potential additive effects**
Adult worker	**Inhalation volatiles and fugitive dust – surface soil**	**3.6×10^{-5}**	**Chromium VI**
Child visitor	**Dermal contact-surface soil**	**3.4×10^{-5}**	**Arochlor-1260**
Youth visitor	**Dermal contact-surface soil**	**3.5×10^{-5}**	**Arochlor-1260**
Adult worker	**Dermal contact-surface soil**	**4.7×10^{-5}**	**Arochlor-1260**
Child visitor	**Dermal contact-subsurface soil**	**2.6×10^{-5}**	**Benzo[a]pyrene**
Youth visitor	**Dermal contact-subsurface soil**	**2.02×10^{-5}**	**Benzo[a]pyrene**
Adult worker	**Dermal contact-subsurface soil**	**1.7×10^{-5}**	**Potential additive effects**

8.0 FINDINGS AND CONCLUSION

Significant levels of environmental contamination were detected at the Drumco Site. PCBs, hexavalent chromium, petroleum byproducts, poly-aromatic hydrocarbons and heavy metals were identified in significant levels. Many of these contaminants were documented in levels greater than the allowable levels documented in the MDE June 2008 Site Cleanup Standards and/or November 2010 EPA Risk-Based Concentrations (RBCs). A toxicological evaluation found significant risks from the ingestion, inhalation or dermal contact with site contaminants.

8.1: Groundwater

Inorganic contamination was detected in levels greater than the MDE June 2008 Cleanup Standards for Type I Aquifers and/or November 2010 EPA Risk-Based Concentrations (RBCs) throughout the unfiltered groundwater samples. Arsenic was detected in all samples in levels greater than the regulatory guidelines. Chromium was found in levels greater than regulatory guidelines and significantly above background in samples obtained from the vicinity of the historic tannery's settling pond. Lead was found in levels above regulatory guidelines in all samples however only one sample was significantly above background.

There were significant elevations in several inorganic contaminants across much of the site. Arsenic was detected in levels above regulatory standards in all but three well samples. Aluminum and manganese were still present at levels above MDE Cleanup Standards and/or RBCs in the filtered samples. Barium was the only contaminant detected at levels significantly greater than background.

Low levels of VOCs, SVOCs, pesticides and PCBs were detected in the groundwater samples. Benzene was detected in six samples at levels significantly above background and the regulatory standards. All benzene detections were adjacent to historic locations of site access roads. The samples obtained from GW-2 exhibited the highest levels of benzene and significant levels of seven SVOCs and seven different pesticides. This sample was collected from the center of the site in an area downgradient of the historic Drumco drum storage yard.

8.2: Soils

Metals contamination was detected throughout the surface and subsurface soil sampling with arsenic, chromium, cobalt, lead, and nickel identified at levels exceeding MDE and/or EPA benchmark standards. Arsenic exceeded benchmarks in all site soil samples except SB-15-29 and SB-10-00. Chromium exceeded benchmarks in all soil samples, using the RBC for hexavalent chromium. Chromium levels were generally greater than the 30 ug/kg anticipated level for soils in central Maryland. However, arsenic levels only slightly exceeded the 4.9 ug/kg anticipated level for soils in central Maryland.

The surface sample collected at SB-16 had elevated levels of hexavalent chromium, the highest level of total chromium and significant levels of arsenic, cobalt, nickel and copper. Subsurface samples collected at SB-04 contained chromium at levels three orders of magnitude greater than those anticipated in the Baltimore region. Hexavalent chromium was detected in all but

four surface soil samples at levels generally greater than the EPA RBC and significantly above background. In the subsurface samples, hexavalent chromium was identified in SB-02, SB-05, SB-13, SB-15 and GW-09. The samples at SB-05, SB-02 and SB-15 were greater than the EPA RBC and significantly above background. The sample collected at SB-06 contained hexavalent chromium at 4350 mg/kg, three orders of magnitude greater than the industrial RBC.

VOCs were identified at significant levels in a number of soil samples. Ethylbenzene and PCE were identified in levels significantly greater than the EPA RBCs. BTEX compounds were detected in several borings in levels greater than regulatory guidelines.

SVOCs were identified in surface samples collected from all of the SB-series borings. Several SVOCs were identified at levels three times background in SB-06-00 and SB-08-00. GW series borings exhibited similar trends to the SB series samples. GW-12 samples were relatively clean compared to other samples. This sample was collected at the entrance to the site and is believed to be outside of the fill areas which have been identified on the Drumco property. SVOCs were identified in all subsurface samples.

PCBs were detected in samples collected from several soil borings at the Drumco site in levels above RBCs. The only significant levels of pesticides identified in soil samples were from the surface sample collected at SB-03; levels of heptachlor epoxide and dieldrin were identified at levels slightly greater than the RBC for the two chemicals.

8.3: Surface Water and Sediments

Chromium was identified in SW-2 at a level significantly above background. There were no other significant trends detected in surface water samples.

Sediment samples were collected in the same locations as the surface water samples. The only detections were for metals and SVOCs. Chromium, lead, selenium and cyanide exceeded regulatory limits in sediment. Chromium was detected in significantly elevated levels in both SED-2 and its duplicate SED-04. Benzo(b)fluoranthene was identified in SED-03 at a level significantly above background and above the BTAG level. There were no other detections of SVOC in levels greater than three times the background level or in exceedance of the BTAGs.

8.4: Toxicology

MDE conducted a toxicological evaluation to examine the human health risks associated with the Drumco property. The findings were that there was a defined risk from incidental ingestion, dermal contact with or inhalation of site contaminants. The complete toxicological report is included as an appendix of this report.

8.5: Conclusions

The Drumco site is typical of many contaminated industrial properties. The guidelines for reuse of such properties have been established by MDE in the *Soil Cleanup Standards* and by EPA in their *Risk Based Contaminant Levels, November 2010.* Future use of the property will hinge on achieving the goals set in the guidelines. Most surface soil contaminants are significantly elevated and could place site workers at risk. Many subsurface soils are similarly contaminated. Benzene is detected throughout the site in levels that could contribute to indoor air issues.

(b) (2) [redacted]

Drumco is an improperly closed industrial landfill. (b) (2) [redacted]

(b) (2) [redacted]

9.0 REFERENCES

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5. The Geology of Baltimore City and County, Maryland Geological Survey, Bulletin.
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9. U.S. Environmental Protection Agency, December 2009, Risk-Based Concentration Tables, Region III.
10. http://www.dnr.state.md.us/bay/tribstrat/upper_east/up_east_shore.html
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12. http://www.intelisolve.com/TP40_2yr%20map.htm
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14. http://www.chemistryexplained.com/elements/T-Z/Vanadium.html

10.0 PHOTODOCUMENTATION

APPENDIX I: WELL BORING LOGS

APPENDIX II: LABORATORY DATA PACKAGE

Maryland Department of the Environment
Land Management Administration
Land Restoration Program

MEMORANDUM

TO: Peggy Smith, Section Head
Brownfields Site Assessment Division

FROM: Mark A. Mank, Toxicologist
Land Restoration Program

SUBJECT: Toxicological Data Screen – Drumco, Baltimore City/Anne Arundel County, Maryland

DATE: March 20, 2012

The toxicological data screen for the Drumco site, Baltimore City/Anne Arundel County, Maryland is attached. For the purposes of this evaluation a commercial use scenario was assumed for estimating risk to potentially exposed populations. Soil, sediment, surface water and groundwater samples were analyzed for VOCs, SVOCs, PCBs, metals and select pesticides and herbicides.

The estimated risks from the incidental ingestion of detected noncarcinogenic surface soil contaminants exceeded MDE and EPA recommended risk levels for all commercial populations using the maximum detected concentrations as the site-wide average concentrations. The estimated risks from the incidental ingestion of detected noncarcinogenic surface soil contaminants exceeded MDE and EPA recommended risk levels for the child visitor, youth visitor and construction worker commercial populations using the 95% UCL concentrations as the site-wide average concentrations. The estimated risks from the incidental ingestion of detected noncarcinogenic surface soil contaminants were below MDE and EPA recommended risk levels for the adult worker population using the 95% UCL concentrations as the site-wide average concentrations. The estimated risks from the incidental ingestion of detected carcinogenic surface soil contaminants exceeded MDE recommended risk ranges for all commercial populations and EPA recommended risk ranges for the child visitor population using the maximum detected concentrations and 95% UCL concentrations as the site-wide average concentrations. The estimated risks from the incidental ingestion of detected carcinogenic surface soil contaminants were below EPA recommended risk ranges for the adult worker, youth visitor and construction worker commercial populations using the maximum detected concentrations and 95% UCL concentrations as the site-wide average concentrations. Noncarcinogenic risk estimates for the incidental ingestion of detected subsurface soil contaminants exceeded MDE and EPA recommend risk levels for the child visitor and construction worker commercial populations using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations. The estimated risks from the incidental ingestion of detected noncarcinogenic subsurface soil contaminants were

below MDE and EPA recommended risk levels for the youth visitor and adult worker populations using the maximum detected concentrations and 95% UCL concentrations as the site-wide average concentrations. Risk estimates for the incidental ingestion of detected carcinogenic subsurface soil contaminants exceeded MDE recommended risk ranges for all commercial populations and EPA recommended risk ranges for the child visitor commercial population using the maximum detected concentrations as the site-wide average concentrations. Subsurface soil incidental ingestion risk estimates were within EPA recommended risk ranges for the youth visitor, adult worker and construction worker commercial populations using the maximum detected concentrations as the site-wide average concentrations. Risk estimates for the incidental ingestion of detected carcinogenic subsurface soil contaminants exceeded MDE recommended risk ranges for the child visitor, youth visitor and adult worker commercial populations using the 95% UCL concentrations as the site-wide average concentrations. Subsurface soil incidental ingestion risk estimates were within MDE recommended risk ranges for the construction worker commercial population and EPA recommended risk ranges for all commercial populations using the 95% UCL concentrations as the site-wide average concentrations.

The estimated noncarcinogenic risks from the inhalation of detected and nondetected volatiles and fugitive dust from surface soils were within acceptable levels as recommended by MDE and EPA for all commercial populations using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations. The estimated carcinogenic risks from the inhalation of detected volatiles and fugitive dust from surface soils exceeded recommended MDE risk ranges for the adult worker commercial population using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations. The estimated carcinogenic risks from the inhalation of detected volatiles and fugitive dust from surface soils were within MDE acceptable risk ranges for the child visitor, youth visitor and construction worker commercial populations and EPA recommended risk ranges for all commercial populations. The estimated noncarcinogenic risks from the inhalation of detected volatiles and fugitive dust from subsurface soils were within acceptable levels as recommended by MDE and EPA for all commercial populations using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations, however, detection limits were elevated in several samples leading to a higher degree of uncertainty when evaluating this exposure pathway. The estimated carcinogenic risks from the inhalation of detected volatiles and fugitive dust from subsurface soils exceeded MDE recommended risk ranges for the adult worker commercial population using the maximum detected concentrations as the site-wide average concentrations. The estimated carcinogenic risks from the inhalation of detected volatiles and fugitive dust from subsurface soils were within acceptable MDE risk ranges for the child visitor, youth visitor and construction worker commercial populations and EPA recommended risk ranges for all commercial populations using the maximum detected concentrations as the site-wide average concentrations. The estimated carcinogenic risks from the inhalation of detected volatiles and fugitive dust from subsurface soils were within MDE and EPA recommended risk ranges for all commercial populations using the 95% UCL concentrations as the site-wide average concentrations.

Risk estimates for dermal exposure to detected noncarcinogenic surface soil contaminants exceeded MDE and EPA recommended risk levels for all commercial populations (using the

maximum detected concentrations and 95% UCL concentrations as the site-wide average concentrations. Risk estimates for dermal exposure to detected carcinogenic surface soil contaminants exceeded MDE recommended risk ranges for the child visitor, youth visitor and adult worker commercial populations using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations. Risk estimates for dermal exposure to detected carcinogenic surface soil contaminants were below MDE recommended risk ranges for the construction worker commercial population and EPA recommended risk ranges for all commercial populations using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations. Risk estimates for dermal exposure to detected noncarcinogenic subsurface soil contaminants exceeded MDE and EPA recommended risk levels for the child visitor and construction worker commercial populations using the maximum detected concentrations as the site-wide average concentrations. Risk estimates for dermal exposure to detected noncarcinogenic subsurface soil contaminants were below MDE and EPA recommended risk levels for the youth visitor and adult worker commercial populations using the maximum detected concentrations as the site-wide average concentrations. Risk estimates for dermal exposure to detected and nondetected noncarcinogenic subsurface soil contaminants were below MDE and EPA recommended risk levels for all commercial populations using the 95% UCL concentrations as the site-wide average concentrations. Risk estimates for dermal exposure to detected carcinogenic subsurface soil contaminants exceeded MDE recommended risk ranges for the child visitor, youth visitor and adult worker commercial populations using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations. Risk estimates for dermal exposure to detected carcinogenic subsurface soil contaminants were within MDE recommended risk ranges for the construction worker commercial population and EPA recommended risk ranges for all commercial populations using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations.

The maximum concentration of lead detected in soils on site, exceeded the 400 mg/kg residential and 1000 mg/kg MDE nonresidential soil screening values. The mean surface soil, subsurface soil and total lead concentrations on site were 200, 401 and 323 mg/kg, respectively. Based upon these results, lead contamination in the specific sampling locations may pose a threat to the health of sensitive populations and the environment.

The estimated risks from incidental ingestion of detected and nondetected noncarcinogenic and carcinogenic contaminants in sediment were below MDE and EPA recommended levels of risk for all commercial populations using the maximum detected concentrations as the site-wide average concentration. Noncarcinogenic and carcinogenic risk estimates for dermal contact with detected and nondetected contaminants in sediment were below MDE and EPA recommended risk levels for all commercial populations. The maximum concentration of lead detected in sediment on site was less than the 400 mg/kg residential soil screening value. Based on the available data the concentrations of lead in sediment should not pose a threat to the health of sensitive populations and the environment. No detected contaminant or nondetected contaminant exceeded its respective NOAA ERM value.

Groundwater at the site is not used as a potable water supply, and public drinking water is available. The evaluation of groundwater as a potable water supply is provided for comparative

purposes only. Potential adverse effects from groundwater exposure were evaluated utilizing dissolved metals and total metals concentration data on site. Risk estimates from the incidental ingestion of detected noncarcinogenic groundwater contaminants exceeded MDE and EPA recommended risk levels for all commercial populations using both total and dissolved metals data. Risk estimates from the incidental ingestion of detected carcinogenic groundwater contaminants exceeded MDE and EPA recommended risk ranges for all commercial populations using total metals data. Multiple detected contaminants were the carcinogenic groundwater ingestion risk drivers using the total metals data set. Risk estimates from the incidental ingestion of detected carcinogenic groundwater contaminants exceeded MDE recommended risk ranges for all commercial populations and EPA recommended risk ranges for the adult worker, youth visitor and child visitor commercial populations using the dissolved metals data. Risk estimates from the incidental ingestion of detected carcinogenic groundwater contaminants were within EPA recommended risk ranges for the construction worker population using the dissolved metals data set.

Risk estimates for dermal contact with detected noncarcinogenic groundwater contaminants exceeded MDE and EPA recommended risk levels for all commercial populations using total metals data. Risk estimates for dermal contact with detected noncarcinogenic groundwater contaminants exceeded MDE and EPA recommended risk levels for the adult worker, child visitor and construction worker commercial populations using dissolved metals data. Risk estimates from dermal contact with detected noncarcinogenic groundwater contaminants were below MDE and EPA recommended risk levels for the youth visitor commercial population. Risk estimates for dermal contact with detected carcinogenic groundwater contaminants exceeded MDE recommended risk ranges for the adult worker, youth visitor and child visitor commercial populations and EPA recommended risk ranges for the adult worker commercial population using both the total and dissolved metals data sets. Risk estimates for dermal contact with detected carcinogenic groundwater contaminants were within MDE recommended risk ranges for the construction worker commercial population and EPA recommended risk ranges for the child visitor, youth visitor and construction worker commercial populations using total and dissolved metals data. The lack of critical physical constants and the methods for derivation of dermal exposures lead to a high degree of uncertainty associated with this route of exposure. This high degree of uncertainty should be considered when evaluating the hazards of dermal exposure to groundwater.

Nine detected groundwater contaminants and eight nondetected analytes exceeded their respective MCL or SMCL. Multiple detected groundwater (dissolved metals) contaminants exceeded the freshwater AWQS or AWQC for the protection of aquatic life (acute or chronic) and human health via fish consumption.

Noncarcinogenic and carcinogenic risk estimates for the incidental ingestion of detected and nondetected surface water (dissolved metals and total metals) contaminants while swimming were below MDE and EPA recommended risk levels for all populations. Four detected surface water contaminants exceeded the freshwater AWQS or AWQC for the protection of aquatic life (acute or chronic). Two detected surface water contaminants exceeded the freshwater criteria for protection of human health via fish consumption.

No detected contaminant in groundwater exceeded EPA or MDE recommended levels of noncarcinogenic or carcinogenic risks for vapor intrusion. Multiple detected noncarcinogenic and carcinogenic soil contaminants, mercury, ethylbenzene, xylenes, naphthalene and heptachlor, exceeded a hazard index of one or a cancer risk of 1×10^{-5} for vapor intrusion of volatiles to indoor air.

Multiple detected and nondetected groundwater and surface water contaminants exceeded their corresponding MDE groundwater cleanup standard. Multiple detected and nondetected soil contaminants exceeded their MDE non-residential soil cleanup standard. Two detected sediment contaminants, arsenic and chromium, exceeding their corresponding non-residential soil cleanup standard.

Refer to the attached toxicological evaluation for details regarding specific risk drivers for each exposure pathway.

Please contact me (x3436) if you have any questions.
/MAM
attachment

Drumco
Baltimore City/Anne Arundel County, Maryland
Toxicological Evaluation

Summary

This toxicological evaluation examines the human health risks associated with the Drumco property in Baltimore City/Anne Arundel County, Maryland. This site was evaluated for child visitor (1-6 years), youth visitor (6-17), adult worker and construction worker populations under a commercial future use scenario. This toxicological evaluation evaluates risks to commercial use populations only. Residential use scenarios are expected to have greater levels of risk and should be evaluated to reflect appropriate land use scenarios. The United States Environmental Protection Agency (EPA) has recommended default exposure parameters that were used to estimate cumulative risk from all chemicals (1, 2, and 3). EPA recognizes as an acceptable Hazard Index (HI) values less than or equal to 1 (noncarcinogenic chemicals) and excess lifetime cancer risk (CR) less than or equal to 10^{-6} to 10^{-4}. The Maryland Department of the Environment (MDE) recognizes as an acceptable HI values less than or equal to 1 and excess lifetime cancer risk less than or equal to 10^{-6} to 10^{-5}. Risks to ecological receptors were evaluated by comparing groundwater and surface water contaminant concentrations to ambient surface water quality criteria values to evaluate potential impact to nearby surface water. Sediment contaminant concentrations were compared to effects range-median values to evaluate potential impact to sediment dwelling receptors. Based on these exposures, estimated risks at the site were compared to MDE and EPA recommended levels, and the following conclusions were reached:

Summary table of Hazard Indices (HI) values and Cancer Risk (CR) values for each commercial population

Noncarcinogenic Endpoints Detected Contaminants Only			
Population	**Pathway**	**Hazard Index**	**Risk Drivers**
Child visitor	Ingestion – surface soil	17	Chromium VI, cobalt, nickel, Arochlor 1254
Youth visitor	Ingestion-surface soil	3	Potential additive effects
Adult worker	Ingestion-surface soil	2	Potential additive effects
Construction worker	Ingestion – surface soil	17	Chromium VI, cobalt, nickel, Arochlor 1254
Child visitor	Ingestion – subsurface soil	7	Arochlor 1254
Construction worker	Ingestion – subsurface soil	7	Arochlor 1254
Child visitor	Dermal contact – surface soil	19	Chromium VI, Arochlor 1254
Youth visitor	Dermal contact – surface soil	13	Chromium VI
Adult worker	Dermal contact – surface soil	11	Chromium VI
Construction worker	Dermal contact – surface soil	16	Chromium VI
Child visitor	Dermal contact – subsurface soil	2	Potential additive effects
Construction worker	Dermal contact – subsurface soil	2	Potential additive effects
Child visitor	Ingestion – groundwater (dissolved)	30	Arsenic, cobalt, iron, manganese, Arochlor-1254, benzene
Youth visitor	Ingestion – groundwater (dissolved)	22	Arsenic, cobalt, iron, manganese, Arochlor-1254
Adult worker	Ingestion – groundwater (dissolved)	12	Arochlor-1254
Construction worker	Ingestion – groundwater (dissolved)	36	Arsenic, chromium, cobalt, iron, manganese, Arochlor-1254, benzene
Child visitor	Dermal contact – groundwater (dissolved)	2	Potential additive effects

Adult worker	Dermal contact – groundwater (dissolved)	7	Chromium
Construction worker	Dermal contact – groundwater (dissolved)	4	Chromium

Carcinogenic Endpoints Detected Contaminants Only

Population	Pathway	Cancer Risk	Risk Drivers
Child visitor	Ingestion-surface soil	2.1×10^{-4}	Arochlor-1254, Arochlor-1260, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene dibenzo[a,h]anthracene
Youth visitor	Ingestion-surface soil	5.3×10^{-5}	Arochlor-1260, benzo[a]pyrene
Adult worker	Ingestion-surface soil	4.4×10^{-5}	Arochlor-1260
Construction worker	Ingestion – surface soil	1.7×10^{-5}	Potential additive effects
Child visitor	Ingestion-subsurface soil	3.3×10^{-4}	Arsenic, Arochlor-1242, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene dibenzo[a,h]anthracene
Youth visitor	Ingestion-subsurface soil	7.2×10^{-5}	Benzo[a]pyrene
Adult worker	Ingestion-subsurface soil	4.4×10^{-5}	Benzo[a]pyrene
Construction worker	Ingestion – subsurface soil	1.7×10^{-5}	Potential additive effects
Adult worker	Inhalation volatiles and fugitive dust – surface soil	4.5×10^{-5}	Chromium VI
Adult worker	Inhalation volatiles and fugitive dust – subsurface soil	2.3×10^{-5}	Ethylbenzene
Child visitor	Dermal contact-surface soil	6.2×10^{-5}	Arochlor-1260, benzo[a]pyrene
Youth visitor	Dermal contact-surface soil	5.9×10^{-5}	Arochlor-1260, benzo[a]pyrene
Adult worker	Dermal contact-surface soil	7.4×10^{-5}	Arochlor-1254, Arochlor-1260
Child visitor	Dermal contact-subsurface soil	9.6×10^{-5}	Benzo[a]pyrene, dibenzo[a,h]anthracene
Youth visitor	Dermal contact-subsurface soil	7.4×10^{-5}	Benzo[a]pyrene
Adult worker	Dermal contact-subsurface soil	6.4×10^{-5}	Arochlor-1242, benzo[a]pyrene
Child visitor	Ingestion – groundwater (dissolved)	3.2×10^{-4}	Arsenic, Arochlor-1242, Arochlor-1254, Arochlor-1260, benzene, benzo[a]anthracene, ethylbenzene
Youth visitor	Ingestion – groundwater (dissolved)	4.6×10^{-4}	Arsenic, Arochlor-2142, Arochlor-1248, Arochlor-1254, Arochlor-1260, benzene, benzo[a]anthracene, ethylbenzene
Adult worker	Ingestion – groundwater (dissolved)	5.0×10^{-4}	Arsenic, aldrin, Arochlor-2142, Arochlor-1248, Arochlor-1254, Arochlor-1260, benzene, benzo[a]anthracene, ethylbenzene and heptachlor epoxide
Construction worker	Ingestion – groundwater (dissolved)	6.0×10^{-5}	Arsenic
Child visitor	Dermal contact – groundwater (dissolved)	1.9×10^{-5}	Potential additive effects
Youth visitor	Dermal contact – groundwater (dissolved)	2.7×10^{-5}	Potential additive effects
Adult worker	Dermal contact – groundwater (dissolved)	1.4×10^{-4}	Benzene, dieldrin, DDD,DDT, ethylbenzene

Summary table of Hazard Indices (HI) values and Cancer Risk (CR) values for commercial populations utilizing 95% UCL concentrations (soil only)

Noncarcinogenic Endpoints			
Population	**Pathway**	**Hazard Index**	**Risk Drivers**
Child visitor	Ingestion – surface soil	9	Chromium VI
Youth visitor	Ingestion-surface soil	2	Potential additive effects
Construction worker	Ingestion – surface soil	9	Chromium VI
Child visitor	Ingestion – subsurface soil	2	Potential additive effects
Construction worker	Ingestion – subsurface soil	2	Potential additive effects
Child visitor	Dermal contact – surface soil	14	Chromium VI
Youth visitor	Dermal contact – surface soil	10	Chromium VI
Adult worker	Dermal contact – surface soil	8	Chromium VI
Construction worker	Dermal contact – surface soil	12	Chromium VI
Carcinogenic Endpoints			
Population	**Pathway**	**Cancer Risk**	**Risk Drivers**
Child visitor	Ingestion-surface soil	1.1×10^{-4}	Arochlor-1260, benzo[a]pyrene, dibenzo[a,h]anthracene
Youth visitor	Ingestion-surface soil	3.1×10^{-5}	Arochlor-1260
Adult worker	Ingestion-surface soil	2.7×10^{-5}	Arochlor-1260
Construction worker	Ingestion – surface soil	1.0×10^{-5}	Potential additive effects
Child visitor	Ingestion-subsurface soil	9.3×10^{-5}	Benzo[a]pyrene
Youth visitor	Ingestion-subsurface soil	2.0×10^{-5}	Potential additive effects
Adult worker	Ingestion-subsurface soil	1.3×10^{-5}	Potential additive effects
Adult worker	Inhalation volatiles and fugitive dust – surface soil	3.6×10^{-5}	Chromium VI
Child visitor	Dermal contact-surface soil	3.4×10^{-5}	Arochlor-1260
Youth visitor	Dermal contact-surface soil	3.5×10^{-5}	Arochlor-1260
Adult worker	Dermal contact-surface soil	4.7×10^{-5}	Arochlor-1260
Child visitor	Dermal contact-subsurface soil	2.6×10^{-5}	Benzo[a]pyrene
Youth visitor	Dermal contact-subsurface soil	2.0×10^{-5}	Benzo[a]pyrene
Adult worker	Dermal contact-subsurface soil	1.7×10^{-5}	Potential additive effects

Site Description

The former Drumco Drum Dump Property is located approximately ¼ mile south of Curtis Bay, off Pennington Avenue (Route 173). The Site is situated between the southwestern Baltimore City Limit and Anne Arundel County, Maryland. The 14.243-acre parcel of land is a former tannery and landfill situated in an industrial setting. The primary portion of the parcel under investigation (14.193 acres) lies in Anne Arundel County and 0.05 acres of the parcel lie in Baltimore City. Access to the Site is by way of Aspen Street off Pennington Avenue in Baltimore. The geographic coordinates are North 39° 12' 45" and west 76° 35' 30" longitude. The Maryland grid coordinates for the Site are 502,800 feet north by 915,900 feet east. The Site is identified on the Anne Arundel County Tax map 5, grid 3, parcel 47 and is currently owned by WHD Properties, LLC with a listed street address of 1500 Arundel Boulevard, Baltimore, Maryland 21255.

The Chas S. Walton & Company, Inc. operated a tannery in the center of the Site between 1923 and 1966. In 1966 the property ownership changed to D. R. Garrat and is identified as being vacant on the 1966 Sanborn map. The tannery was abandoned and demolished in the late 1960s to early 1970s. From the mid 1970s to approximately 1980, the Site was used as a construction debris landfill with significant mounding of unknown fill materials over the previous ground surface and extension of fill into wetland areas on the southern and southeastern portions of the Site. In the early 1990s the site was used by Drumco, a drum recycler, as a storage yard for drums awaiting reconditioning. The Maryland Department of the Environment (MDE) discovered a large number of full drums containing hazardous waste hidden under stacked empty drums in a fenced storage yard. MDE requested the assistance of the U.S. Environmental Protection Agency (EPA). A site assessment confirmed the MDE findings, resulting in an emergency drum removal, which began on July 1, 1991.

The former Drumco Drum Dump Site was first inspected by MDE in September 26, 1990 in response to several complaints of hazardous materials being stored on the Site. Leaking drums of caustic materials were discovered in a trailer used for drum storage and evidence of soil contamination from drum spillage was observed. The drums were subsequently removed by MDE for proper off-site disposal; the operator of the facility, Mr. George Garratt was advised to clean up the storage yard. During an inspection of the facility on January 12, 1991, MDE observed that Site conditions had deteriorated. Drums were stored chaotically throughout the Site and spillage from drums was evident. MDE issued a formal complaint and order to Drumco Inc., on January 21, 1991, for violations of Maryland water control and solid waste management laws. Mr. George Garratt was subsequently found guilty and was sentenced to 90 days in jail and fined $50,000 for violations of Maryland Environmental Laws.

In March 1991, MDE investigated the Drumco Site in response to a report to the Maryland Crime Unit that 200 drums containing hazardous waste were hidden among the thousands of empty drums. MDE discovered six suspected waste drums hidden underneath several piles of empty drums. Four of the drums contained multilayered flammable liquids; one of the drums contained corrosives and one drum did not exhibit the characteristic of flammability or corrosivity. After evaluating the scope of the potential cleanup, MDE requested EPA assistance, and on April 1, 1991, the EPA Region III Superfund Removal Branch performed a removal

assessment. The Removal Assessment team determined that the Site presented a direct contact threat to humans, a fire hazard, and a potential threat for additional releases of hazardous substances from leaking weathered drums. The EPA Regional Administrator authorized funding to mitigate the threat posed to human health and the environment on June 7, 1991. On July 1, 1991, the EPA Technical Assistance Team and Environmental Technology, Inc. mobilized to the Site to begin removal activities. Site work was completed on May 28, 1992. A total of 23,733 drums were removed from the Site; 5,544 drums contained materials. Before removal, drums were sampled and analyzed to classify the waste. Sample analyses included Toxicity Characteristic Leaching Procedure volatiles (TCLP), TCLP semivolatiles (SVOCs), TCLP phenols, TCLP pesticides, oil and grease, pH, ignitability, flash point, polychlorinated biphenyls (PCBs) and cyanide. MDE performed a preliminary assessment (PA) of the Drumco Site in December 1992. On April 14, 1993, Halliburton NUS and Gannett Flemming performed a Site Screening Inspection (SSI) and an SSI report for the Drumco Site was completed in November 1993.

The former Drumco Drum Dump Site consists of a mounded grassy plateau surrounded by trees growing along the slopes of the plateau. The southern portion of the Site is situated on illegally backfilled wetlands. The Valley Proteins rendering plant is located to the east of the Site beyond the railroad tracks. The Baltimore Pennington Landfill (now closed) is located to the north of the Site. The southern portion of the Site lies adjacent to wetlands and the tidally influenced portion of Cabin Branch. A Hess Petroleum Terminal is located south of Cabin Branch and the Drumco Drum Site. Cabin Branch flows into Curtis Bay, which is contiguous with Baltimore Harbor and the Chesapeake Bay. No potable drinking water wells exist within ½ mile of the site.

1.0 Method

In evaluating risk to human health, maximum concentrations of all chemicals detected in soil, sediment, groundwater and surface water were compared to medium-specific screening levels (EPA Region III Risk Based Concentration values and Maryland Department of the Environment Cleanup Standards (1,2)). Chemicals that exceeded human health Regional Screening Level (RSL) values were then evaluated quantitatively. Relevant toxicological data and RSL values from surrogate compounds (structurally similar analogues) were used for some of the chemicals with no corresponding RSL value. Groundwater data were collected from geoprobe locations on the site. The evaluation of groundwater was performed as if the water were being used as drinking water. Soil, sediment and surface water samples were collected from locations on the property.

1.1 Human Health

Maximum concentrations of all chemicals detected in soil and sediment (dry weight values) were compared to the EPA Regional Screening Level (RSL) table values for residential soil (1). Comparison of dry weight analytical values to the RSLs is recognized as a conservative measure but provides consistency in risk assessments across sites (with variable soil moisture content) and sampling time. Groundwater and surface water maximum concentrations were compared to the EPA RSLs for tap water. Prior to comparison with each chemical concentration, noncarcinogenic RSLs were multiplied by 0.1, in order to account for any additivity of systemic

effects. Carcinogenic RSL values were not adjusted and represent a target risk level of 10^{-6}. Carcinogenic and noncarcinogenic risk levels for all contaminants that exceeded their respective RSL screening level were evaluated quantitatively. The quantitative evaluation was based on expected future use and development scenarios and includes populations typically expected to frequent the site based on this proposed future use. For those soil contaminants identified as potential risk drivers 95% upper confidence limit (95% UCL) values were calculated when a sufficient number of samples (ten per soil horizon) were collected (3).

The future land use at the site was assumed to be commercial, therefore, the commercial exposure scenario was used to evaluate risk at the site. The contaminants identified at the site at concentrations that exceeded residential RSLs were further evaluated with regard to risk to relevant populations under the following scenarios (4, 5, 6, 7 and 8):

Commercial Development:

Soil:

Adult Worker: 70 kg body weight, 3280 cm^2 skin surface area (soil), 250 days per year exposure for soil ingestion, 50 mg soil ingested per day, 8 hours inhalation, 0.05 mg/cm^2-event soil to skin adherence factor. 1 m^3/hour inhalation rate, 25-year exposure duration, 70-year lifetime.

Construction Worker: 70 kg body weight, 3280 cm^2 skin surface area (soil), 0.05mg/cm^2-event soil to skin adherence factor, 250 days per year exposure for soil ingestion, 480 mg soil ingested per day, 1.5 m^3/hour inhalation rate, 8 hour exposure time (inhalation soil), 1 year exposure duration, 70 year lifetime.

Youth (6 - 17 years) Visitor: 40 kg body weight, 4320 cm^2 skin surface area (soil), 0.02mg/cm^2-event soil to skin adherence factor, 132 days per year soil ingestion, 100 mg soil ingested per day, 0.56 m^3/hour inhalation rate, 4 hours inhalation exposure, 12 year exposure duration, 70 year lifetime.

Child (1 - 6 years) Visitor: 15 kg body weight, 2350 cm^2 skin surface area (soil), 0.06mg/cm^2-event soil to skin adherence factor, 132 days per year soil ingestion, 200 mg soil ingested per day, 0.32 m^3/hour inhalation rate, 4 hour inhalation exposure, 6 year exposure duration, 70 year lifetime.

Sediment:

Adult Worker: 30-year exposure duration, 70 kg body weight, 3280 cm^2 skin surface area (soil), 52 days per year exposure for soil ingestion, 50 mg soil ingested per day, 4 hours inhalation, 0.05 mg/cm^2-event soil to skin adherence factor. 1 m^3/hour inhalation rate, 70-year lifetime.

Construction Worker: 70 kg body weight, 3280 cm^2 skin surface area (soil), 0.05mg/cm^2-event soil to skin adherence factor, 52 days per year exposure for soil ingestion, 480 mg soil ingested per day, 1.5 m^3/hour inhalation rate, 4 hour exposure time (inhalation soil), 1 year exposure duration, 70 year lifetime.

Youth (6 - 17 years) Visitor: 40 kg body weight, 4320 cm^2 skin surface area (soil), 0.02mg/cm^2-event soil to skin adherence factor, 52 days per year soil ingestion, 100 mg soil ingested per day, 0.56 m^3/hour inhalation rate, 4 hours inhalation exposure, 12 year exposure duration, 70 year lifetime.

Child (1 - 6 years) Visitor: 15 kg body weight, 2350 cm^2 skin surface area (soil), 0.06mg/cm^2-event soil to skin adherence factor, 52 days per year soil ingestion, 200 mg soil ingested per day, 0.32 m^3/hour inhalation rate, 4 hour inhalation exposure, 6 year exposure duration, 70 year lifetime.

Groundwater:

Adult Worker: 70 kg body weight, 1 liter drinking (ground) water ingested per day, 5670 cm^2 skin surface area, 250 days per year drinking (ground) water ingestion, 25-year exposure duration, 70 year lifetime.

Construction Worker: 70 kg body weight, 5670 cm^2 skin surface area (groundwater), 250 days per year drinking (ground) water ingestion, 3 liter drinking (ground) water ingested per day, 1 year exposure duration, 70 year lifetime.

Youth (6 - 17 years) Visitor: 40 kg body weight, 13100 cm^2 skin surface area (groundwater), 132 days per year drinking (ground) water ingestion, 2 liter drinking (ground) water ingested, 12 year exposure duration, 70 year lifetime.

Child (1 - 6 years) Visitor: 15 kg body weight, 6560 cm^2 skin surface area (groundwater), 132 days per year drinking (ground) water ingestion, 1 liter drinking (ground) water ingested, 6 year exposure duration, 70 year lifetime.

Surface Water:

Adult Swimmer: 70 kg body weight, 12 events per year, 50 ml water ingested per event, 1 hour exposure time per event, 30 year exposure duration, 70 year lifetime.

Youth Swimmer (6 - 17 years): 40 kg body weight, 12 events per year, 50 ml water ingested per event, 1 hour exposure time per event, 12 year exposure duration, 70 year lifetime.

Child Swimmer (1 - 6 years): 15 kg body weight, 12 events per year, 50 ml water ingested per event, 1 hour exposure time per event, 6 year exposure duration, 70 year lifetime.

2.0 Human Health Evaluation

Soil, sediment, surface water and groundwater samples were analyzed for VOCs, SVOCs, PCBs, metals and select pesticides and herbicides. Chemicals that were detected on site were compared to medium-specific screening levels (EPA RSL values). Chemicals that were not detected at the site and exceeded RSL values (at an assumed concentration of one half the detection level) were

carried through the quantitative risk assessment and were included in the summation of noncarcinogenic hazard quotients and carcinogenic cancer risk values for comparative purposes only. Chemicals detected at the site that exceeded human health RSL values were evaluated quantitatively using the maximum detected concentration as the site-wide average concentration. No RSL values were available for 4-bromophenyl phenyl ether, 4-chloro-3-methylphenol, 4-chlorophenyl phenyl ether and bromochloromethane, however, these chemicals were not detected in any medium on site. Based upon historical site operations and the non-detection of these chemicals, they were not included in the quantitative risk estimates. Magnesium, calcium, potassium and sodium are essential nutrients that were detected on site and are toxic only at very high concentrations. These compounds are found naturally in soils and sediment in this geographic region, therefore, they are not included in the quantitative risk estimates.

The EPA has issued a directive for lead that recommends a soil screening level of 400 mg/kg for residential scenarios at RCRA facilities and CERCLA sites; the 400-mg/kg soil screening level was used in this evaluation for soil (9). MDE has a nonresidential lead cleanup standard of 1000 mg/kg. The 400 mg/kg residential screening level and 1000 mg/kg MDE soil cleanup standard were used in this evaluation.

2.1 Soil

Soil samples were analyzed VOCs, SVOCs, PCBs, metals and select pesticides and herbicides. Contaminants that were detected above their respective residential soil RSLs (i.e. failed the initial screening process, see Attachment A) were evaluated quantitatively. Surface and subsurface soil exposures were evaluated via the ingestion, inhalation, dermal contact and vapor intrusion of volatiles to indoor air pathways. Reference dose (RfD) and cancer slope factor (CSF) values were obtained from EPA Region III and IRIS (1,10). Estimates of noncarcinogenic and carcinogenic risks from dermal contact were calculated when sufficient data (permeability constants (11), oral absorption efficiencies and dermal absorption factors (12)) were available.

2.2 Sediment

Sediment samples were analyzed VOCs, SVOCs, PCBs, metals and select pesticides and herbicides. The chemicals detected in sediment that exceeded the residential soil RSLs (see Attachment A) were evaluated quantitatively. Sediment exposures were evaluated via the ingestion, inhalation and dermal contact pathways. Sediments were evaluated conservatively using surface soil exposure scenarios. Reference dose (RfD) and cancer slope factor (CSF) values were obtained from EPA Region III and IRIS (1,10). Additionally, for comparative purposes only, sediment contaminant concentrations were compared to effects range-median (ERM) guidelines (13) to assess potential adverse effects to sediment dwelling organisms.

2.3 Groundwater

Groundwater samples from the site were analyzed for VOCs, SVOCs, PCBs, metals and select pesticides and herbicides. Contaminants that were detected above their respective RSL screening level (Attachment A) were evaluated quantitatively for risk. Groundwater exposures were evaluated via the ingestion, dermal contact and vapor intrusion of volatiles to indoor air

pathways. Estimates of noncarcinogenic and carcinogenic risks from dermal contact were calculated when sufficient data (permeability constants (11), oral absorption efficiencies and dermal absorption factors (12)) were available. Organic and inorganic contaminants detected in groundwater were also compared to their corresponding MCL (Maximum Contaminant Level). Additionally, groundwater contaminant concentrations were compared to Maryland's ambient water quality standards (AWQS) and EPA's recommended ambient water quality criteria (AWQC) for the protection of aquatic life and human health.

2.4 Surface Water

Surface water samples from the site were analyzed for VOCs, SVOCs, PCBs, metals and select pesticides and herbicides. Contaminants that were detected above their respective RSL screening level (Attachment A) were evaluated quantitatively for risk. Surface water exposures were evaluated via the incidental ingestion while swimming or wading pathway. Surface water contaminant concentrations were compared to Maryland's ambient water quality standards (AWQS) and EPA's recommended ambient water quality criteria (AWQC) for the protection of aquatic life and human health.

2.5 Vapor Intrusion

All volatile and semivolatile contaminants detected in soil and groundwater on site were quantitatively evaluated for vapor intrusion using the Johnson and Ettinger Tier I vapor intrusion model (14).

2.6 MDE Cleanup Standards Screen

All sediment, surface water and groundwater samples collected on site were compared to the MDE *State of Maryland Department of the Environment Cleanup Standards for Soil and Groundwater* Interim Final Guidance, June 2008 (2).

3.0 Conclusion

3.1 Soil

The estimated risks from the incidental ingestion of detected noncarcinogenic surface soil contaminants exceeded MDE and EPA recommended risk levels for all commercial populations (Table 1) using the maximum detected concentrations as the site-wide average concentrations. Chromium VI, cobalt, nickel and Arochlor-1254 and potential additive effects were the surface soil ingestion noncarcinogenic risk drivers. The estimated risks from the incidental ingestion of detected noncarcinogenic surface soil contaminants exceeded MDE and EPA recommended risk levels for the child visitor, youth visitor and construction worker commercial populations (Table 1UCL) using the 95% UCL concentrations as the site-wide average concentrations. Chromium VI and potential additive effects were the surface soil ingestion noncarcinogenic risk drivers using the 95% UCL concentrations as the site-wide average concentrations. The estimated risks from the incidental ingestion of detected noncarcinogenic surface soil contaminants were below MDE and EPA recommended risk levels for the adult worker population using the 95% UCL

concentrations as the site-wide average concentrations. The estimated risks from the incidental ingestion of detected carcinogenic surface soil contaminants exceeded MDE recommended risk ranges for all commercial populations and EPA recommended risk ranges for the child visitor population (Tables 2 and 2UCL) using the maximum detected concentrations and 95% UCL concentrations as the site-wide average concentrations. Arochlor-1254, Arochlor-1260, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene and dibenzo[a,h]anthracene were the surface soil ingestion carcinogenic risk drivers. The estimated risks from the incidental ingestion of detected carcinogenic surface soil contaminants were below EPA recommended risk ranges for the adult worker, youth visitor and construction worker commercial populations using the maximum detected concentrations and 95% UCL concentrations as the site-wide average concentrations. Noncarcinogenic risk estimates for the incidental ingestion of detected subsurface soil contaminants exceeded MDE and EPA recommend risk levels for the child visitor and construction worker commercial populations (Tables 3 and 3UCL) using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations. Arochlor-1254 and potential additive effects were the subsurface soil ingestion noncarcinogenic risk drivers. The estimated risks from the incidental ingestion of detected noncarcinogenic subsurface soil contaminants were below MDE and EPA recommended risk levels for the youth visitor and adult worker populations using the maximum detected concentrations and 95% UCL concentrations as the site-wide average concentrations. Risk estimates for the incidental ingestion of detected carcinogenic subsurface soil contaminants exceeded MDE recommended risk ranges for all commercial populations and EPA recommended risk ranges for the child visitor commercial population (Table 4) using the maximum detected concentrations as the site-wide average concentrations. Arsenic, Arochlor-1242, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene and dibenzo[a,h]anthracene were the subsurface soil ingestion carcinogenic risk drivers. Subsurface soil incidental ingestion risk estimates were within EPA recommended risk ranges for the youth visitor, adult worker and construction worker commercial populations using the maximum detected concentrations as the site-wide average concentrations. Risk estimates for the incidental ingestion of detected carcinogenic subsurface soil contaminants exceeded MDE recommended risk ranges for the child visitor, youth visitor and adult worker commercial populations (Table 4UCL) using the 95% UCL concentrations as the site-wide average concentrations. Benzo[a]pyrene and potential additive effects were the subsurface soil ingestion carcinogenic risk drivers. Subsurface soil incidental ingestion risk estimates were within MDE recommended risk ranges for the construction worker commercial population and EPA recommended risk ranges for all commercial populations using the 95% UCL concentrations as the site-wide average concentrations.

The estimated noncarcinogenic risks from the inhalation of detected and nondetected volatiles and fugitive dust from surface soils were within acceptable levels as recommended by MDE and EPA for all commercial populations (Tables 5 and 5UCL) using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations. The estimated carcinogenic risks from the inhalation of detected volatiles and fugitive dust from surface soils exceeded recommended MDE risk ranges for the adult worker commercial population (Tables 6 and 6UCL) using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations. Chromium VI was the fugitive dust carcinogenic risk driver. The estimated carcinogenic risks from the inhalation of detected

volatiles and fugitive dust from surface soils were within MDE acceptable risk ranges for the child visitor, youth visitor and construction worker commercial populations and EPA recommended risk ranges for all commercial populations. The estimated noncarcinogenic risks from the inhalation of detected volatiles and fugitive dust from subsurface soils were within acceptable levels as recommended by MDE and EPA for all commercial populations (Tables 7 and 7UCL) using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations, however, detection limits were elevated in several samples leading to a higher degree of uncertainty when evaluating this exposure pathway. The estimated carcinogenic risks from the inhalation of detected volatiles and fugitive dust from subsurface soils exceeded MDE recommended risk ranges for the adult worker commercial population (Table 8) using the maximum detected concentrations as the site-wide average concentrations. Ethylbenzene was the carcinogenic volatile inhalation risk driver. The estimated carcinogenic risks from the inhalation of detected volatiles and fugitive dust from subsurface soils were within acceptable MDE risk ranges for the child visitor, youth visitor and construction worker commercial populations and EPA recommended risk ranges for all commercial populations using the maximum detected concentrations as the site-wide average concentrations. The estimated carcinogenic risks from the inhalation of detected volatiles and fugitive dust from subsurface soils were within MDE and EPA recommended risk ranges for all commercial populations (Table 8UCL) using the 95% UCL concentrations as the site-wide average concentrations.

Risk estimates for dermal exposure to detected noncarcinogenic surface soil contaminants exceeded MDE and EPA recommended risk levels for all commercial populations (Tables 9 and 9UCL) using the maximum detected concentrations and 95% UCL concentrations as the site-wide average concentrations. Arochlor-1254, chromiumVI and potential additive effects were the dermal contact surface soil risk drivers. Risk estimates for dermal exposure to detected carcinogenic surface soil contaminants exceeded MDE recommended risk ranges for the child visitor, youth visitor and adult worker commercial populations (Tables 10 and 10UCL) using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations. Arochlor-1254, Arochlor-1260 and benzo[a]pyrene were the carcinogenic dermal contact surface soil risk drivers. Risk estimates for dermal exposure to detected carcinogenic surface soil contaminants were below MDE recommended risk ranges for the construction worker commercial population and EPA recommended risk ranges for all commercial populations using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations. Risk estimates for dermal exposure to detected noncarcinogenic subsurface soil contaminants exceeded MDE and EPA recommended risk levels for the child visitor and construction worker commercial populations (Table 11) using the maximum detected concentrations as the site-wide average concentrations. Potential additive effects were the dermal contact subsurface soil noncarcinogenic risk drivers. Risk estimates for dermal exposure to detected noncarcinogenic subsurface soil contaminants were below MDE and EPA recommended risk levels for the youth visitor and adult worker commercial populations using the maximum detected concentrations as the site-wide average concentrations. Risk estimates for dermal exposure to detected and nondetected noncarcinogenic subsurface soil contaminants were below MDE and EPA recommended risk levels for all commercial populations (Table 11UCL) using the 95% UCL concentrations as the site-wide average concentrations. Risk estimates for dermal exposure to detected carcinogenic subsurface soil

contaminants exceeded MDE recommended risk ranges for the child visitor, youth visitor and adult worker commercial populations (Tables 12 and 12UCL) using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations. Arochlor-1242, benzo[a]pyrene, dibenzo[a,h]anthracene and potential additive effects were the carcinogenic subsurface soil risk drivers. Risk estimates for dermal exposure to detected carcinogenic subsurface soil contaminants were within MDE recommended risk ranges for the construction worker commercial population and EPA recommended risk ranges for all commercial populations using both the maximum detected concentrations and the 95% UCL concentrations as the site-wide average concentrations.

The maximum concentration of lead detected in soils on site, exceeded the 400 mg/kg residential and 1000 mg/kg MDE nonresidential soil screening values. The mean surface soil, subsurface soil and total lead concentrations on site were 200, 401 and 323 mg/kg, respectively. Based upon these results, lead contamination in the specific sampling locations may pose a threat to the health of sensitive populations and the environment.

3.2 Sediment

The estimated risks from incidental ingestion of detected and nondetected noncarcinogenic and carcinogenic contaminants in sediment were below MDE and EPA recommended levels of risk for all commercial populations (Tables 13 and 14) using the maximum detected concentrations as the site-wide average concentration. Noncarcinogenic and carcinogenic risk estimates for dermal contact with detected and nondetected contaminants in sediment were below MDE and EPA recommended risk levels (Table 15 and 16) for all commercial populations. The maximum concentration of lead detected in sediment on site was less than the 400 mg/kg residential soil screening value. Based on the available data the concentrations of lead in sediment should not pose a threat to the health of sensitive populations and the environment.

No detected contaminant or nondetected contaminant exceeded its respective NOAA ERM value (Table 17).

3.3 Groundwater

Potential adverse effects from groundwater exposure were evaluated utilizing dissolved metals and total metals concentration data on site. Risk estimates from the incidental ingestion of detected noncarcinogenic groundwater contaminants exceeded MDE and EPA recommended risk levels (Tables 18 and 18Diss) for all commercial populations using both total and dissolved metals data. Arsenic, chromium, cobalt, iron, manganese, Arochlor-1254 and benzene were the dissolved metals groundwater ingestion risk drivers for the affected commercial populations. Risk estimates from the incidental ingestion of detected carcinogenic groundwater contaminants exceeded MDE and EPA recommended risk ranges (Table 19) for all commercial populations using total metals data. Multiple detected contaminants were the carcinogenic groundwater ingestion risk drivers using the total metals data set. Risk estimates from the incidental ingestion of detected carcinogenic groundwater contaminants exceeded MDE recommended risk ranges (Table 19Diss) for all commercial populations and EPA recommended risk ranges for the adult worker, youth visitor and child visitor commercial populations using the dissolved metals data.

Arsenic, aldrin, Arochlor-2142, Arochlor-1248, Arochlor-1254, Arochlor-1260, benzene, benzo[a]anthracene, ethylbenzene and heptachlor epoxide were the incidental ingestion dissolved metals risk drivers. Risk estimates from the incidental ingestion of detected carcinogenic groundwater contaminants were within EPA recommended risk ranges for the construction worker population using the dissolved metals data set.

Risk estimates for dermal contact with detected noncarcinogenic groundwater contaminants exceeded MDE and EPA recommended risk levels for all commercial populations (Table 20) using total metals data. Chromium, vanadium and potential additive effects were the groundwater dermal contact total metals risk drivers. Risk estimates for dermal contact with detected noncarcinogenic groundwater contaminants exceeded MDE and EPA recommended risk levels for the adult worker, child visitor and construction worker commercial populations (Table 20Diss) using dissolved metals data. Chromium was the groundwater noncarcinogenic dermal contact risk driver. Risk estimates from dermal contact with detected noncarcinogenic groundwater contaminants were below MDE and EPA recommended risk levels for the youth visitor commercial population. Risk estimates for dermal contact with detected carcinogenic groundwater contaminants exceeded MDE recommended risk ranges for the adult worker, youth visitor and child visitor commercial populations and EPA recommended risk ranges for the adult worker commercial population (Tables 21 and 21Diss) using both the total and dissolved metals data sets. Benzene, dieldrin and ethylbenzene were the carcinogenic dermal contact risk drivers. Risk estimates for dermal contact with detected carcinogenic groundwater contaminants were within MDE recommended risk ranges for the construction worker commercial population and EPA recommended risk ranges for the child visitor, youth visitor and construction worker commercial populations using total and dissolved metals data. The lack of calculable dermal hazard values for many of the contaminants of concern result from the limited availability of required physical constants (permeability constants (8), oral absorption efficiencies and dermal absorption factors (9)) for estimating carcinogenic and noncarcinogenic risk. The lack of critical physical constants and the methods for derivation of dermal exposures lead to a high degree of uncertainty associated with this route of exposure. This high degree of uncertainty should be considered when evaluating the hazards of dermal exposure to groundwater.

Groundwater contaminant concentrations (dissolved metals) were compared to available MCLs and SMCLs. Nine detected groundwater contaminants and eight nondetected analytes exceeded their respective MCL or SMCL (Table 22Diss). Groundwater contaminant concentrations were also compared to available freshwater and marine Maryland ambient water quality standards (AWQS) or EPA recommended ambient water quality criteria (AWQC). Multiple detected groundwater (dissolved metals) contaminants exceeded the freshwater AWQS or AWQC for the protection of aquatic life (acute or chronic) and human health via fish consumption (Table 23Diss).

3.4 Surface Water

Noncarcinogenic and carcinogenic risk estimates for the incidental ingestion of detected and nondetected surface water (dissolved metals and total metals) contaminants while swimming were below MDE and EPA recommended risk levels for all populations (Tables 24 through 25Diss). Surface water contaminant concentrations (dissolved metals) were also compared to available Maryland AWQS or EPA recommended AWQC for freshwater and marine

environments (Table 26Diss). Four detected surface water contaminants exceeded the freshwater AWQS or AWQC for the protection of aquatic life (acute or chronic). Two detected surface water contaminants exceeded the freshwater criteria for protection of human health via fish consumption.

3.5 Vapor Intrusion

The risk from subsurface vapor intrusion of detected volatile contaminants in groundwater and soil into buildings was evaluated using the Johnson and Ettinger vapor intrusion model (Attachment B). No detected contaminant in groundwater exceeded EPA or MDE recommended levels of noncarcinogenic or carcinogenic risks for vapor intrusion. Multiple detected noncarcinogenic and carcinogenic soil contaminants, mercury, ethylbenzene, xylenes, naphthalene and heptachlor, exceeded a hazard index of one or a cancer risk of 1×10^{-5} for vapor intrusion of volatiles to indoor air.

3.6 MDE Cleanup Standards Screen

Maximum concentrations of all chemicals analyzed for in soil, sediment, groundwater and surface water were compared to their corresponding MDE non-residential cleanup standard (Attachment A). Multiple detected and nondetected groundwater and surface water contaminants exceeded their corresponding MDE groundwater cleanup standard. Multiple detected and nondetected soil contaminants exceeded their MDE non-residential soil cleanup standard. Two detected sediment contaminants, arsenic and chromium, exceeding their corresponding non-residential soil cleanup standard.

3.7 Evaluation Assumptions

When determining whether an increased risk to human health exists at this site, it is important to understand that this evaluation was prepared as a first level screening evaluation. Many conservative assumptions are included in this evaluation, which were developed with the understanding that if the estimated risk, using the conservative assumptions, does not exceed EPA's recommended levels, then the risk estimated using more realistic scenarios will not exceed these levels.

Since this evaluation includes many conservative assumptions, a risk that exceeds EPA's recommended level of risk does not necessarily indicate an increased risk to human health. When this situation occurs, it is necessary to consider several points when determining if the risk actually does represent a threat to human health. For example, the quantitative risk estimate in this evaluation assumes people will be exposed to a contaminant at the maximum concentration all throughout the site and for the entire exposure duration. These assumptions do not take into account whether the maximum concentration is anomalous or characteristic of the site, or that biodegradation, dispersion, dilution, or other factors may decrease the contaminant concentration throughout the time of exposure.

This evaluation also assumes that the bioavailability of each contaminant is 100 percent, and that all of the contaminant taken into the body is absorbed across the digestive tract into the body. A chemical is harmful to human health only if it is absorbed into the body. Assuming complete bioavailability does not consider the fact that it is common for a fraction of the chemical taken into the body to be excreted rather than absorbed into the body. The bioavailability of a contaminant is dependent on many factors, such as the state or form of the contaminant and if the actual size of the contaminant particle would permit incidental ingestion. These issues must be considered when evaluating the appropriateness of assuming total bioavailability of a contaminant.

4.0 References

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